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THE OUTLOOK FOR NUCLEAR POWER IN THE US

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THE OUTLOOK FOR NUCLEAR POWER IN THE US

INTRODUCTION

Nuclear power expansion in the US remains stalemated, as concern over energy increases. Although the Administration has said that nuclear power is now an essential part of the nation's energy program, government promotion has been ineffective. This report discusses how this situation developed and delineates prerequisites for the expansion of nuclear power in the US.

This discussion assumes that:

- Plants in operation will remain in operation. Shutdowns for safety-related modifications prompted by the Three Mile Island (TMI) accident have caused, and will continue to cause, only temporary losses of production.
- Most licensed projects will proceed. A few cancellations and a number of deferrals are expected. Nevertheless, the predominant majority will be completed.
- Plants which have been ordered, but not yet licensed, are unlikely to proceed for some time.

The discouraging prospects for new plant orders will be substantially worsened if the first two assumptions prove overly optimistic.

PRECIS

1. Study after study (the latest by the National Academy of Sciences) concludes that:
   a. The US will need more electric power.
   b. Only coal and uranium can fill that future need.
   c. The primary need is to shift from an electric power generation system dependent in large measure upon scarce fuels (oil and gas), to one dependent upon plentiful fuels—namely, coal and uranium.
2. The US is steadily decreasing its energy options. Limited supplies of oil and gas, probable restrictions on coal usage, a stalemated nuclear power program leave no other practical alternatives open. National policy decisions must be made and implemented which free coal and uranium from those steadily tightening constraints.
3. Achieving solutions to the long-term energy problem lies almost wholly within the political realm. Fuel is available. Technology is available. A favorable political environment is not.
4. National energy policy, particularly nuclear power policy, is confused. Neither industry nor government understands what is expected of the other. Policies which will attract broad government, public and industry support are urgently needed. Short-term prospects for such policies are dismal.
5. A sense of urgency is not likely to develop until electric power shortages are evident. A few, limited area shortages are probable within the next few years, but they are unlikely to be severe enough to give nuclear power a big boost.
6. Coal will continue to be favored over nuclear power for five years or more. After coal's limitations become more publicly apparent, and nuclear power is more widely perceived as preferable, the revival of US nuclear power will be possible. That may occur in the mid-to-late 1980's. A gradual, rather than rapid, turnaround is probable.
7. From the time nuclear power plant orders effectively halted (about 1975) until a reactivation of orders begins (about 1985), roughly ten years will have elapsed. Siting, design, operating, financing, regulatory, and other conditions will have changed substantially. An industry re-emerging in 1985 is unlikely to have the same conceptual form as that which existed in 1975.
8. Cautious planning by the uranium industry is justified, using these assumptions:
   a. Consumption during the 1980's can be calculated with reasonable confidence, based on plants in operation and under construction. New plants, even if ordered, will have an inconsequential effect before the 1990's.
   b. Uncertainty is largely "downside uncertainty." Potential delays, deferrals and cancellations have a much greater chance of decreasing consumption than do new plants of increasing it.
   c. Few, if any, additional nuclear power plants are likely to be ordered before the mid-1980's. Once new plant orders are placed, there will be time to adjust production accordingly.

THE POLITICS OF NUCLEAR POWER

Energy problems are approached from two fundamentally different points of view—one *political*, the other *economic*. The political point of view sees energy as an instrument which can be used to gain power, a weapon for advancing ideology, and a foundation which, if undermined, can lead to the restructuring of society. The economic viewpoint holds that ample energy supplies are necessary for the material well-being of a stable society.

A report, written ten years ago, concerned with the future of nuclear power would have concentrated on the economic side—cost-of-power, load-growth projections, and technological comparisons. Political considerations would have been secondary.

Today, the situation is dramatically different. Forecasts no longer confidently assume seven percent annual growth. New oil and gas plants are ruled out by law. Nuclear power is enmeshed in political controversy. Coal, once handicapped by its image as a dirty fuel, is now the preferred fuel, mainly due to political constraints on alternative fuels. Passive technologies are promoted for political reasons even though they are impractical for technical and economic reasons. Every aspect of energy is politically influenced—decisively so.

Growth in Politicization of Energy

Early nuclear power development assumed public acceptance would follow as technical and economic solutions became evident. What was not, and could not have been, foreseen was the extent to which nuclear power would become the instrument of political activism. The board of directors of a utility now has to be primarily concerned with whether a site and facility will be licensed, start-up permitted, and continuity of operation anticipated. In such a case, a business judgment is largely a political assessment.

In a substantial way, current social and political influences go back to a shifting public attitude over the past couple of decades. The *first* shift has been an increase in skepticism that technological progress automatically leads to social progress. Anything disciplined, technical, complex, and large tends to be suspect. The *second* major shift resulted from a growing realization that energy is a foundation upon which modern industrial society depends. Factions interested in political influence have, accordingly, jumped into the energy fray.

Energy and Ideology

One aspect of energy which particularly heightened interest by the extreme left is consistent with Marx's theories. Marx was among the first to believe society could be structured according to predetermined concepts. Marx hit upon a concept of government control over the "principal means of production" to provide the leverage.

Marx's fundamentals have not been lost on those concerned with reshaping society. Control of the essential element of production—energy—could lead to control of the "principal means of production," and control of those could lead to political control. Energy moved from the lowest rung on the political ladder, where it resided until ten to twenty years ago, to the top.

Nuclear Power and Ideology

Until the 1960's, American internal political schisms were modest. Later, civil rights, the Vietnam War, Watergate and other issues widened the schisms. Reaction against traditional values grew. The search for new identities produced a segment which sought to be set aside from mainstream society. Political causes having an importance visualized as overshadowing personal destiny became necessary.

A minority developed out of this which constituted an "alienation party" dedicated to opposing society's accepted objectives. A loosely-knit leadership emerged. Ralph Nader, Jane Fonda, Tom Hayden, Bella Abzug, Barry Commoner and Daniel Ellsberg are among the leaders. That leadership has rallied around nuclear power as "The Cause" with rallies, protest meetings, sit-ins and other opposition activities expressing alienation.

The depth of ideological attachment to the nuclear power issue was demonstrated by result of competition with the "Boat People" issue. Millions have died, and may still be dying, in Cambodia and Vietnam. Hundreds of thousands have fled without knowing where, or whether, their boats might land. Joan Baez, the famous singer and human rights advocate, publicly accused the Vietnamese government of gross human rights violations. Nationwide advertisements were published to that effect, with many previous anti-war colleagues as cosigners. Public attention focused on Vietnamese and Cambodian actions.

Jane Fonda took issue with the Baez position. A publicized feud developed as some sided with Fonda for criticizing Baez, and some sided with Baez, who views herself as apolitical. A prominent leftist attempted to defuse the problem in order to minimize the division. Baez, he argued, was wrong for even raising the issue. He said that, "Socialist governments should not be criticized even when they do violate human rights;" and, "Most refugees are of Chinese origin;" and, "Even the American Revolution produced a number of displaced persons." Upon the heels of this reasoning came the key concern: "Another issue should not have been raised if it detracted from leftist concentration on nuclear power." In other words, substance was not that important; political value was.

The "Soft Path"

Since a negative image is not politically desirable, a positive image was needed once it became apparent that a position had developed which opposes virtually all forms of electric power generation. A position developed, in short, which was seriously in need of a rationale. The rationale which eventually emerged found that oil, gas, coal and nuclear constituted the "hard path," with economics setting the course. "Control by corporations," centralized power stations, pollution, etc., had been the result.

The proper alternative, according to the new rationale, was the "soft path" shaped by social policy. The favored energy source has become solar power, which, among other merits, would allow the return to a pastoral society. The theoretically *desirable,* and wholly political, viewpoint was decisively important. Economic and technical *feasibility* was of no concern.

Political Spectrum

Political classifications are difficult to define, as related to nuclear power, but three general groups are of interest. The first is strongly ideological nuclear opposition. Second, at the opposite end, is a strongly pro-nuclear element. Third, and most important, is an in-between group which may become either more or less favorably disposed towards nuclear power.

The ideological group anchors strong opposition on one side; the conservative element anchors the other side. Nuclear power's future will be determined by the delicate balance in the center. Many may favor nuclear power in principle, but are nevertheless concerned about safety, environmental and other problems. Many may oppose having a plant in *their* area, while favoring nuclear power in general.

Nuclear power can move ahead in spite of those opposed to it for radical ideological reasons. A democratic system, in fact, provides for this for reasons which have nothing to do with nuclear power. But nuclear power cannot move ahead without support of the center group, and that has to be strong enough to overwhelm the deep-seated ideological opposition.

GOVERNMENT, CRISES AND PROBLEM-SOLVING

It is widely assumed that crises will force rational government action. As applied to energy, the view is that a shortage of energy will force accelerated construction of new generation capability. Nuclear will be widely perceived as a necessary component.

Unfortunately, history does not demonstrate that rational responses are necessarily the result of crises. The opposite is often the case, as public pressures force expedient solutions.

An electricity crisis is not likely to develop as a clearly visible, well-defined, well-formed crisis. The challenge will be blurred. The nature of government is not such that response can be crisp and immediately effective. The response will be blurred.

A nationwide shortage of electricity will not occur as a single event. The shortage, when it occurs, will more probably be an accumulation of events. Adjustments can be made as best they can, on a gradual basis. Political repercussions will be avoided by selective adjustments (such as cut-backs in aluminum production). A number of variables, as discussed later, will impinge upon the timing of any shortages (such as reserve margin, conservation, plant availability, etc.). Predicting the point at which a shortage will be acute is not practical. Any government response, therefore, is likely to be surrounded by political controversy. Solutions are likely to inch forward rather than develop as major strides.

Government has several basic characteristics which make formulation of coherent policy and its implementation difficult. Three are of special relevance.

The first of these has been aptly labelled "Balkanization of government," and has to do with its size, diversity and external forces.

Government has grown, almost unrestrained, since the 1930's. The causes of this may not be fully understood. Perhaps the national mood favored turning over individual responsibility when government was eager to assume it. Whatever the cause, energy followed the general trend. Energy and government are deeply intertwined.

"Balkanization" entails the division of a problem into that number of parts required to fit the structure of the organization. An oil problem, for example, will involve the Executive Office, Department of Energy, Department of State, Council of Economic Advisors, Council on Environmental Quality, National Security Council and others. Each of those major organizations must subdivide its share of the problem to accommodate its own internal structure.

Government components usually have dual loyalties. One loyalty is to the organization of which it is a part. Another is to the special external constituency viewed as its ally. The Department of Labor, for example, is beholden to unions; the Commerce Department to business; the Environmental Protection Agency to environmentalists, and so on. Adding to centrifugal forces developed by those special interests are those of Congress, with its numerous budgetary, oversight, etc., committees.

The result is that decisions can be arrived at only slowly and with numerous compromises. Coherent, consistent policy is an unlikely response to even a clearly-defined challenge—and it is not likely in a complicated matter such as energy.

A second has to do with natural conflict between national goals and practical politics. Government is forced to operate on dual planes functioning in opposite directions simultaneously, much as trade winds do. National interest carries policy in one direction (such as energy self-sufficiency), while practical politics carries it in another (such as wealth redistribution). The result often produces situations in which one program cancels another. For example, a California tax credit subsidizes solar power in an effort to reduce the use of oil, while a federal tax credit is under consideration to compensate those who must rely on expensive heating oil. Will a tax credit encourage the use of one, but not the other?

A third characteristic concerns use of massive irrationality. Irrationality, if it is major, can form its own politically protective screen providing it is so confusing that it appears that only government can cope.

Examples can easily be found to show how these characteristics, alone or in combination, function in the political system. For example, northern California was victimized by simultaneous electricity and gasoline shortages in 1979. The gasoline shortage, the President advised, would be alleviated if only each California family would reduce consumption by a few gallons per week. The electricity shortage was caused by shutdown of the Rancho Seco nuclear power plant and start-up delays of the twin Diablo Canyon units. Reserve margin had dropped to four percent.

Operation of the three nuclear power plants would have saved oil at a rate of 30,000,000 barrels per year (more than several gallons per family per week), increased the reserve margin to an adequate level, and saved ratepayers many millions of dollars.

The Governor, politics and ideology set aside, had an easy, straightforward opportunity to solve the problems by an accelerated effort to place nuclear stations in operation quickly. His actions, however, were quite different than one might expect. They included urging the President to keep Rancho Seco shut down, participation in an anti-nuclear protest rally at Diablo Canyon, a commitment to the public to do all in his personal power to prevent Diablo Canyon from ever operating, and an attempt to further his presidential candidacy by promising to make the "California Energy Model" the "National Energy Model."

Situations with this type political involvement encourage political panaceas to meet short-term political needs. President Carter has proposed his "Comprehensive Energy Plan" and "Moral Equivalent of War." Governor Brown proposes "a recognition of an era of limits" and "lowered expectations." None stands the test of rational analysis if energy production is an important consideration in the supply/demand balance.

These peculiarities in the political process do not suggest that we should expect a sudden crystallization of understanding for any complex situation. Rather, they suggest that what we are more apt to see is a sort of problem-solving process which takes three steps forward and two steps backward.

EFFECTS OF TMI

Public Acceptance of Nuclear Power

Nuclear power is exceptionally vulnerable to the politics of fear. Radiation cannot be seen, felt, smelled, tasted or heard. That which cannot be sensed can be much more frightening than that which can. Only a small fraction of the public has seen the exterior of a nuclear power station—fewer still the interior. Nuclear power remains unfamiliar to the public in terms of concrete, personal experience.

Most issues which arise within a democracy are resolved by majority vote. A tax issue may arouse debate, but voters accept the outcome. However, an issue which inspires fear cannot necessarily be resolved simply by majority vote. Minority concerns assume a much greater importance. Satisfactory resolution may require overwhelming support.

Many in the nuclear industry tend to take undue comfort in public opinion polls. Although polls usually favor nuclear power by about three to two, this ratio is not sufficient for a dynamic nuclear program. A utility, moreover, cannot rely on national polls for guidance. Even people who favor expansion of nuclear power on a national basis may oppose local construction.

Nuclear Power and the News Media

Every successful political and social movement depends upon support by the news media. Not only does nuclear power not enjoy favorable news coverage, but is portrayed in a way that inherent evils far outweigh inherent virtues. A few examples serve to illustrate:

- A radio announcer, on Albert Einstein's birthday: "Albert Einstein invented atomic energy. He also did many good things, such as . . . "
- During a television interview following TMI, Joseph Califano, then Secretary of Health, Education and Welfare, explained that updated calculations indicated the potential for one additional cancer death among the 2,000,000 people within a 50-mile radius of the TMI site. The expected cancer death rate from natural causes was 325,000 whereas the accident could raise the figure to 325,001. An interviewer's question, antagonistically presented, "Is nuclear power worth even one death?"
- Two months after TMI, a newspaper published 2,000 miles from the scene of the "incident," contained the following Associated Press report: "About two ounces of low-level radioactive water spilled onto a laboratory floor . . . No one was injured and there are no after effects." Merely publishing this sort of trivial occurrence attached to it an importance totally out of proportion to any conceivable justification.

There are some deeply ingrained reasons for biased coverage and most will not change soon. They include:

- The leaders of the news media, on the whole, see themselves as responsible for setting national priorities, and many do not support nuclear power.
- Exaggerated events stressing the humanist viewpoint are most effective as a successful means of market competition. "Potential disasters" receive maximum attention.
- The news media do not police each other. Inaccuracies reported usually go unnoticed and unchallenged. Corrections are usually buried in the back pages, no matter how extensive the original coverage.

– Reporters often do not understand the subject matter.

  Example: TMI:s "explosive hydrogen bubble" generated the greatest-ever volume of news for a single event. As was demonstrated later, there had been no potential for explosion.

  Example: The evacuation of 144,000 residents from the Harrisburg area attracted enormous attention, while the arrival of hundreds of the world's most knowledgeable nuclear experts at the TMI site was not considered to be newsworthy.

The news media shape public thinking, and public opinion eventually determines political policy. Nuclear power will remain stalemated, regardless of its intrinsic assets and liabilities, until a more positive attitude on the part of the news media builds public and political support.

Nuclear Power as a Presidential Election Issue

Presidential campaigns are currently underway. A new or modified cabinet will be in place in 1981. At least two years of uncertainty lie ahead.

California's Governor Brown has taken progressively more anti-nuclear positions. He supports a moratorium on new construction of nuclear plants, phasing out operating plants, and abandonment of projects in the planning stage. Massachusetts' Senator Kennedy favors a moratorium on new construction, but not the shutdown of operating plants. (New England receives more than one-third of its electric power from nuclear energy.) President Carter, who called nuclear power a "last resort" energy source during his campaign in 1976, is now defending it. All leading Republican candidates support nuclear power.

No one can predict the outcome of the election. Unforeseeable events often play the decisive role. However, the US government, like all stable political institutions, is based on the orderly transfer of power. Each president is bound by past obligations and present realities. Therefore, the longer-term course of nuclear power may depend less on the officeholder than on energy realities. Nevertheless, the possibility of substantial change always exists, and a prudent utility's board of directors must take that into account. It would take unusual business courage to support aggressive nuclear power development without benefit of a positive, or at least neutral, political climate.

Government Safety Regulation

A regulated industry contains within it seeds of danger which may flower when least expected. New problems are met with new procedures. Procedures become crutches. A spread of divided responsibilities may not be recognized either by those being regulated or those providing regulation. Responsibility may unintentionally shift from the operating site—the point of application, to Washington—the point of political focus. Emphasis on engineering safety can become an exercise in pacifying regulatory bodies. An accident such as TMI brings concerns of this type into view as natural defense mechanisms are forced into play.

A virtual nervous breakdown within the Nuclear Regulatory Commission has been one result, understandably, as it has been required to defend its past actions, reorganize, cope with emergencies, review utility operations, consider new licenses and respond to investigative bodies, all in the face of enormous political pressures.

Industry, on the other hand, has invested much time, money and effort in responding to government requirements. After years of coping with continually increasing regulatory requirements—effort

which proved inadequate—industry cannot avoid the conclusion that fundamentally new directions are needed. Self-sufficiency will be the foremost aim guiding future development.

One outcome of the TMI accident, therefore, will be a recasting of basic policy. Industry will do whatever is internally necessary to ensure safety. Government may provide a check, but not a crutch. This alone will reshape industry for many years.

Industry Interdependence

The extent to which all the organizations within the nuclear power industry depend upon one another had not been fully appreciated before TMI. Now it is universally clear that an accident at any one plant affects all. Every nation with nuclear power generation capability is considering new laws, regulations and revised programs in the wake of TMI.

The US utility industry has responded vigorously to the lessons of TMI, in part through the Electric Power Research Institute (EPRI). A Nuclear Safety Analysis Center (NSAC) and an Institute of Nuclear Power Operations (INPO) have also been established. Nuclear Electric Insurance Limited (NEI) is being formed to insure utilities against financial adversity. The problem of making fully adequate technical resources available to all utilities, especially those with few nuclear units, is receiving more attention. Investors, management and the public have become much more sensitive to nuclear safety and public attitudes as a result of TMI.

Legal Uncertainties

Numerous legal events which tend to place additional and non-specific obligations upon the industry have taken place.

Third-party Claims Against the Operators and Suppliers: Numerous individual and class action suits have been filed. More are expected.

Indemnification: The Price-Anderson statute limits the amount of nuclear operators' liabilities to third parties. Efforts are being made to declare that limitation invalid if "gross negligence" can be proved.

Price-Anderson Continuation: Lobbying pressure is being applied on Congress to eliminate protection under the Price-Anderson Act for future projects.

Property Damage: As plant values now exceed one billion dollars, property damage is of increasing importance.

Corporate Liability: Although the Karen Silkwood case was unrelated to TMI, the precedent set in the case may be relevant. Karen Silkwood, an employee of a Kerr-McGee Corporation subsidiary, was killed in an automobile accident. An autopsy revealed plutonium contamination. A lawsuit was subsequently brought against Kerr-McGee by the Silkwood estate and the trial jury found in favor of the plaintiff. Damages of $10,500,00 were awarded—the largest ever for such a case. The verdict is under appeal. The merits of the case are not of concern here, but the outlook for industry is. The following concern nuclear power users:

- The plaintiff's legal counsel's style was publicized as being an important factor affecting the outcome.
- The award was made without proof of actual damage. Presumably, plutonium would have caused harm in due time, but death precluded that; proof of actual damage is traditionally required.

– Full responsibility for contamination was placed on Kerr-McGee, which maintained that Ms. Silkwood intentionally contaminated herself. Compliance with government regulations was not an adequate defense in this case, even though government, itself, considered the regulations adequate.

Each adds to an already formidable thicket of legal problems confronting nuclear power.

Financial Uncertainties

The financial structure of a regulated industry is unique. Risk is likely to be borne by shareholders, while benefits are passed, not to them, but to rate payers. Therefore, a low-risk course usually proves most prudent for utilities.

TMI demonstrated problems which made nuclear power appear more risky than alternative technologies from a shareholder's standpoint. A regulatory bias placed a near-maximum financial burden on shareholders for replacement power costs, clean-up costs and rate-base matters concerning both TMI-I and TMI-II. Savings from nuclear operated electricity, which had already been passed along to rate-payers, were apparently not taken into account once the mishap occurred. Partly due to this bias against shareholders, and partly due to licensing uncertainties, some investment advisors believe investments in utilities owning a large nuclear capacity should require a higher rate of return.

Siting Requirements

The accident at TMI initiated a review of siting requirements and pressures for preparation of large-scale evacuation plans. The NRC has even discussed temporarily closing a few plants located in populated areas.

New siting criteria will favor more remote sites and conditions, ensuring that local populations will remain limited over the expected life of a facility. Qualified sites may not be available in some regions.

Technical Infrastructure

The utility industry is aggressively working to provide small nuclear utilities access to technical resources comparable to those available to larger utilities, and to improve generally the support available to all. A perceived current weakness in this infrastructure, however, should not be a serious deterrent to future nuclear projects, as resources will be more than adequate long before any newly-ordered plant begins its operation.

Waste Disposal

Probably the biggest anti-nuclear issue, from a public opinion standpoint, is waste disposal. The opposition claims that nuclear wastes remain radioactive for thousands of years, disposal processes have not been demonstrated and facilities proven capable of surviving the required time have not been demonstrated.

Unfortunately, private industry cannot provide the solutions. Government defines the rules, which are always subject to change. Nor, as the earlier US reprocessing program demonstrated, can industry even be assured that a project will be allowed to operate upon completion. Waste disposal has thus

become a ward of the government sector. To date, no process has been chosen by the US, even though the UK and France have processes in practice. A US site has not been selected. Political pressure to avoid proving solutions exist is probably as great as that to demonstrate solutions.

There is little justification from an engineering standpoint to support the degree of political inaction. A typical nuclear power plant uses about 50,000 pounds of enriched uranium each year. Even stored in solid form, as discharged from the reactor, this amounts to only a few hundred cubic feet per year. After fuel is reprocessed, the remaining fission products amount to only about one cubic yard per year. After being formed into glassified bricks (one solution), the volume amounts to only about 90 cubic feet per year. Handling waste from nuclear power plants is a small task compared to most energy waste systems, which involve massive waste volumes.

The structural problem appears, moreover, to be amenable to a straightforward engineering solution. After the plutonium has been removed, the radioactivity of these wastes will decay in approximately 1,000 years, and that is a relatively short period for structures designed to be permanent. The Egyptian pyramids, built using primitive technology, have already survived several thousand years and appear capable of surviving many thousand more.

Here again, engineering is not being permitted to provide the needed solutions. Political and institutional problems dominate and often present more obstacles than solutions.

PRESSURES ON NUCLEAR POWER

Reserve Margin

Reserve margin, the difference between generating capacity and peak load, has increased during the past half-dozen years from a national average of 20 percent to 34 percent. A reserve margin of 20 percent is usually considered adequate. Reserve capacity, however, is not evenly distributed. Margins in some areas may be only 15 percent, and as high as 40 percent in others. The northwestern US, for example, is currently experiencing a shortage, while some other areas enjoy an excess.

If system loads could be optimally distributed by perfect interties, existing capacity could accommodate the next several years' load growth. Perfect distribution is not, of course, possible, although some improvement is to be expected. The greater this improvement, the longer the time during which the present generating system can meet the need and, thus, the later the point at which shortages are likely to occur.

One important political result of the excess of reserve margin is that the public debate can proceed without any concrete impact registering on the public. Shortages may be predicted, but ample electric power remains available. No evidence of difficulty is clearly visible to the public. Until problems are more imminent, the public may view the electricity generating problem more as a subject for debate than one for action.

One can predict with reasonable accuracy the growth of generating capability for the near term as the sum of existing capacity and projects in progress. However, predicting demand is more difficult. Less predictable influences are involved. Effective conservation and more efficient distribution may defer demand for an uncertain period. The rate of economic growth is also uncertain. The combined effects make it difficult to predict precisely when acute shortages will occur.

This is not to suggest that skimping on capacity is desirable. The cost of excess capacity is small compared to the alternative. Inconvenience and economic loss from inadequate power can be severe. A shortage, moreover, can lead to public pressure for the most expedient solution. That would probably be gas turbines, as they can be placed in service in roughly half the time required for alternates.

Conservation

Correlations between past electricity demand and Gross National Product (GNP) growth show that each one percent increase in real GNP has resulted in about a 1.5 percent increase in electricty demand. While possibly correct for a low-cost energy economy, the same correlation will probably not hold in a high-cost energy economy. A high-cost energy economy is a new development and correlations have yet to be established.

Conservation was, at one time, not fully appreciated as an energy solution. The potential has been underestimated. Awareness of conservation potential has increased as the ethical component and the cost-effective component come into play. Conservation for ethical reasons appeals to basic American anti-waste attitudes. Cost-effectiveness responds to indisputable economic laws.

Early assessments of conservation were based largely on benefits to be derived from elimination of waste. A one-time reduction of seven to ten percent was the popular estimate, and only equal

to about one year's growth with normal rates of increase in electricity demand. The importance of conservation as a long-term solution was, therefore, discounted.

But those estimates were before cost-effectiveness began to encourage savings and to attract ingenuity. High costs are encouraging searches for equal results with less energy—results which will reduce energy consumption surface in various ways. Two examples illustrate:

- The landlord of Nuexco's Menlo Park headquarters reduced energy consumption by more than 70 percent by lighting modifications, the curbing of waste and specially-designed microprocessor controls.
- Government is about to impose a "windfall" profits tax on oil companies. Consumers will buy $200,000,000,000 in taxes with their energy budgets, rather than fuel.

Electricity load-growth projects, for all these reasons, have steadily declined. Five years ago, most assumed a continued expansion of six to seven percent per year. Estimates were reduced to five or six percent several years ago. Recent estimates were three to four percent. The potential savings from waste elimination alone may now equal several years' growth. Conservation may move the once-expected shortage of the early 1980's to the mid-1980's, or beyond.

Conservation requires neither new plants nor fuel, produces no waste and has few opponents. Ideologic controversy is difficult to develop. All the indicators point toward an increasing role for conservation in the total energy solution.

Solar Power

The most fraudulent idea being perpetrated on the public today is that solar power will somehow produce significant amounts of electricity. Only the "technology" remains to be developed. Anti-nuclear, anti-growth groups promote this for their own reasons. Industries, believing they are acting as good citizens, add to the conspiracy by advertising solar research and development as though solar electricity is on its way. Government responds to what it perceives to the public interest by increasing appropriations. A wishful public is eager to believe. The news media are easily excited by the desirability, if not the practicality, of solar power. All of this, despite the fact that economical solar electricity will not occur this century and possibly not in the next.

Solar power's problems begin with nature. The sun spreads low-level energy over large areas and follows daily and seasonal cycles. Effectiveness varies with the weather.

One solution usually offered to these problems is that of providing storage of power for use under adverse conditions. One unit would store energy during favorable conditions while another unit serviced immediate demand.

The solar storage plan has several major weaknesses, not the least of which is the economic one that any usable solar electricity storage system will also be suitable for storing electricity produced by any other source. Proving that solar energy provides the best means for charging that storage facility would be most difficult on any conceivable economic grounds. Solar power would have to compete with *incremental* costs of existing systems operated during off-peak hours. Geothermal power, hydroelectric power, nuclear power, coal, gas and, finally, oil, would be preferred in approximately that order. Capital-intensive solar power would be last in line in incremental competition.

This does not mean that the development of some solar power will not proceed, even though it is uneconomical for electric power. One company recently totaled federal tax credits associated with pending legislation. They equalled 80 percent of project cost. California allows a separate tax credit of 55 percent. Thus, profit (at taxpayer expense) might be realized merely by installing an uneconomical solar system.

System Obsolescence

Generating-system obsolescence is an emerging problem. Both economic and physical obsolescence are closing in.

Prior to 1974, it was not easy for a power plant to become economically obsolete. Oil cost $2 per barrel. Fuel costs for 1000 MWe of capacity might have been $20,000,000 per year. Now fuel costs for the same capacity exceed $200,000,000 per year, and may soon exceed $400,000,000 per year. (Nuclear fuel costs, in comparison, are about $40,000,000.) As oil costs increase, and they will continue to do so, economic pressure to use fuels other than oil will also grow. The nearly 15 percent of the nation's oil-fired generating capacity is already economically obsolete, but replacement would cost more than $100,000,000,000.

Throughout this century, electric generating capacity has doubled each decade. As a consequence, most equipment is relatively new. Half has operated only ten years, but almost 40,000 MWe worth of equipment is more than forty years old. By the time replacements could be in service, that early equipment will be fifty to sixty years old. Within another ten years, an additional 75,000 MWe worth of equipment will be more than forty years old. Every decade will see a doubling of obsolete equipment.

While all power plants have shown a remarkable durability and performed longer than first expected, sooner or later age must take its toll.

Oil

If oil prices have not already made all oil-fired stations obsolete, that will soon be the case. The US cannot limit oil prices as long as it depends on imports for the bulk of its supply. Regulated limits on imports will only provide the basis for increased import prices. Long-term oil consumption will be limited only by consumer resistance. OPEC will adjust, so that a natural economic limit set by market price is slightly lower than the regulatory limit, whatever that may be. The lower the mandatory limit on imports, the higher the price.

The only practical course is a phasing out of oil-fired plants. The only open question is what will replace those.

Gas

Natural gas is more readily available than oil. Gas, however, is not a long-term solution. The Fuel Act of 1978 prohibits the construction of new gas-fired plants and provides that existing gas-fired plants be converted to coal by 1990. Even without legal constraints on the use of gas for electricity generation, gas would still be uneconomical in the long run. Economics will direct use of gas towards applications which cannot be supplied easily by electricity—such as petrochemical feedstocks and transportation.

Coal

About half of US electric power was produced from coal in 1979. Coal is, moreover, the nation's most abundant fuel and is counted upon as a primary fuel of the future. Coal, like all fuels, has problems, many of which are related to the massive quantities involved. A 1000 MWe plant may use more than 800,000 pounds per hour. Roughly 15 percent of that, or 120,000 pounds per hour, will become solid ash. The balance of 680,000 pounds in some form, plus oxygen, will be released to the atmosphere. These emissions include particulate matter, oxides of carbon, nitrogen and sulphur, radionuclides, and other products whose effects are controversial. In addition, 10 to 15 percent of the heat generated is released to the atmosphere. "Acid rain," weather modification and ash disposal are matters of growing concern.

Expanded use of coal is expected to cover:

Conversion – oil and gas plants are being converted to coal

Synfuels – coal is planned for gasoline production

New plants – nearly all electricity generating plants ordered since 1975 utilize coal. Virtually all those ordered in the next five years will also depend on coal.

New uses do not, of course, require an immediate increase in coal utilization. A new coal plant requires eight to ten years for completion. A synfuel plant may take longer. Even conversion from oil to coal utilization requires several years. However, during the next five to ten years, limitations in transportation, waste disposal, mining and environmental concerns will reach more controversial levels. Some believe a ceiling on coal utilization may occur in the 1990's.

Other Alternatives

Geothermal steam is an attractive alternate energy source, but suitable locations are few. During twenty years of aggressive development in California (an especially favorable location), Pacific Gas & Electric Company has placed in operation a total of slightly more than 600 MWe, or half the capacity of a single nuclear plant. Alternate sources, such as wind, biomass, wave power, etc., have many shortcomings similar to those of solar power. All only nibble at the total problem. None alters significantly the ultimate reliance upon coal and uranium.

PREREQUISITES FOR REVIVAL OF US NUCLEAR POWER

Some believe that US nuclear power programs will be "allowed" to proceed under increasingly stringent government safety controls. Being "allowed" is not likely to prove sufficient for growth of the industry. Government, moreover, might even decide the nuclear power programs can proceed, but the final decision in the private sector will be made by investors. Until government policy is backed by concrete assurances satisfactory to those investors—and that may require Congressional action—private utilities may be unwilling to proceed.

A decade ago, nuclear power had an advocate within the government, the Atomic Energy Commission. Mechanisms were developed to encourage use of nuclear power. The change to a "neutral" government atmosphere abolished that Commission, and with it began the disintegration of coherent government nuclear power policy. Government policy has since grown increasingly wary of nuclear power for political reasons, despite the economic and environmental advantages. Conditions worsened after TMI.

What preconditions are necessary to change this trend? What will provide investors with confidence to allocate the enormous funds required? Conditions probably include:

- Positive, or at least neutral, press coverage.
- Strong public acceptance in the area of proposed sites.
- Assurance that the NRC is stable and well-organized.
- Assurance that waste disposal is not a problem which will inhibit progress.
- Belief that alternate technologies, like coal, would not better serve the interests of the shareholder, as well as those of the customer.

The current Congressional mood is not encouraging to nuclear power; rather, the opposite is the case. More and more restrictions are proposed for an already stalled nuclear industry. Conditions which barely allow nuclear power generation need to change into conditions which provide assurance of stability. A public attitude may have to develop with due recognition of:

- The visible threat (or actual experience) of a shortage of electrical energy.
- The need for additional generating capacity is essential.
- Nuclear power as a *necessary* component of future needs.

Congressional action will probably not lead public opinion by much. When public opinion is sufficiently supportive:

- Government may urge utilities to build nuclear plants.
- A workable regulatory and legal framework may be restored.
- Government guarantees may be provided to ensure stability and investor confidence.

A wholesale reversal of the current attitude will provide the turning point at which nuclear power once again becomes an important element of industry.

SPECULATIONS

An industry in which further growth of new plants has been suspended for five years, new plant orders might not be placed for another five years, and is in process of critical internal and external re-examination, is not likely to reappear in the same form. A major reshaping is to be expected. One can envision circumstances which will required accommodation, and the impact some may have.

- Public attitude will influence new site selections with government criteria and constraints fashioned accordingly. Very likely, only remote sites will satisfy new criteria.
- Qualified sites will be rare and each will need to be utilized to the fullest extent practical. Multiple units, perhaps as many as a dozen, might eventually be located at one site. This "park" concept will be more attractive.
- Once clustered in this fashion, integrated design and operation of the complex is a necessary consequence. (Much like the Savannah River and Hanford plants.) New complexes may include on-site provision for waste disposal, transportation and, possibly, reprocessing. A high degree of self-sufficiency is to be expected.

Design of a complex will be approached differently than that of a single plant. More consideration has to be given to local conditions and interplant relationships. Single plants have been designed with a dominant emphasis on the nuclear steam supply system. The pervasive influence of the nuclear steam supply system has tended to decrease, and now constitutes approximately 15 percent of the cost of the nuclear plant, rather than the nearly 50 percent it once was. Moreover, the steam supply system warranty, which once set minimum boundaries for scope of supply, has become less important. This once-rigid boundary has become more flexible and thus allows more flexibility in engineering approach.

One can envision, therefore, the evolution of both a reshaped supplier industry and a reshaped utility operating industry. Forms of ownership and cooperation may be drastically changed and comprehensive engineering will gain importance, while the influence of nuclear steam supply system suppliers may decline. US industry practice may resemble more its foreign counterpart, with a greater degree of plant engineering and nuclear steam supply integration.

A frequent question is whether nuclear plant suppliers will remain capable of supporting a viable plant program. The following argues they will. General Electric began assembling an organization to produce the first commercial nuclear power plant, the 200 MWe Dresden I, in late August of 1955. Recruitment, organization, technical development, design, manufacture (including construction of manufacturing facilities) and construction followed. The plant achieved criticality in October 1959, approximately four years and two months later.

Nuclear resources available to General Electric at the time were largely limited to those which could be drawn from Hanford and Knolls Atomic Power Laboratory. Today, organizations and facilities are already in place. A strong base is available as a result of fuel and services businesses. A technical cadre is available. The resources are there, even though not in the optimal form for a large and rapid build-up.

The problem of greatest concern is whether the procedural obstacles will be manageable. The tendency to equate safety with rigidity of control has increased. The time needed to bring a plant on-line will also increase. Mounting controls and procedures can suffocate the industry.

If government does accommodate public acceptance needs, does provide a constructive financial and legal framework, and if complexes, rather than individual plants, are the focus of new construction, then changes of many types will probably result. Financing, ownership, design and operation will all be affected in many important ways.

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MONTHLY REPORT ON THE URANIUM MARKET

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MONTHLY REPORT ON THE URANIUM MARKET

No. 139 March 1980

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FOREWORD

This month, the cover format of the Nuexco Monthly Report has been changed somewhat. Also, the dating of the Report has been changed to the month in which it is actually published. However, the date on which the Exchange Value, Transaction Value, and other data in the Report are determined remains the last day of the month prior to the month of publication. Thus, the Exchange Value published in this Report was determined as of February 29, 1980.

At the Atomic Industrial Forum's Fuel Meeting in New Orleans, Nuexco will host a luncheon for its Subscribers and their guests on Wednesday, April 16, at 12:30 p.m. Invitations will be issued later, but please reserve the date.

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URANIUM MARKET

PUBLIC AND GOVERNMENT POLICY

In the **US**, the Nuclear Regulatory Commission (NRC) has ended its self-imposed licensing moratorium. The NRC voted unanimously to allow the Tennessee Valley Authority to begin startup operations of unit No. 1 of its Sequoyah plant. The go-ahead for Sequoyah is expected to open the way for several other plants which have been completed, but remain unlicensed due to the NRC's moratorium.

Democratic challengers of US President Carter have become more strident with anti-nuclear rhetoric. In their campaigns for the New Hampshire presidential primary, Senator Kennedy and Governor Brown attempted to win anti-nuclear votes by debating which of the two is the more anti-nuclear, and became so earlier. Both Kennedy and Brown were apparently trying to appeal to the opponents of the Seabrook nuclear plant, located in New Hampshire. Carter won the Democratic primary, held February 26.

Three US nuclear plants (Farley No. 1, Arkansas Nuclear No. 1, and Vermont Yankee) were forced to shut down because of inability to meet an NRC deadline of January 31, 1980 for certain safety changes. Meanwhile, New York State regulators refused an application to build the two Jamesport nuclear units. Instead, a coal-fired plant was approved for the Jamesport site.

A nuclear waste program was sent to Congress by the Carter Administration. The report concludes that both defense and industrial nuclear waste can be safely buried, and time is not of the essence. A site is to be selected by the mid-1980's. The program calls for a full-scale repository to be available by the mid-1990's.

The US announced a cutoff of shipments of phosphate fertilizers to eastern Europe, as part of the Administration's policy on Afghanistan. However, none of the US phosphate producers which recover uranium as a by-product export phosphates to eastern Europe, and are thus not directly affected.

Mexico has reaffirmed its interest in proceeding with nuclear power, partly as a means of conserving its oil resources. Study contracts have been awarded to Swedish, French and Canadian firms in an apparent move to reduce technical dependency upon the United States. The move is interpreted as a reaction to the widely unpopular US nuclear power export policies.

The latest public opinion poll regarding the March 23 nuclear referendum in **Sweden** indicates that 54 percent of the voters are pro-nuclear, 32 percent are against nuclear power, and 14 percent are undecided. Sweden currently has six nuclear units in operation. In addition, fuel loading has commenced at two new units, Forsmark No. 1 and Ringhals No. 3. However startup will not occur until after the referendum, if the outcome is pro-nuclear.

In the **UK**, the government anticipates adding another 15,000 MWe of nuclear capacity, which it hopes will bring nuclear power's share of electric generation up to the 30 percent level. The new units will be pressurized water reactors, and a demonstration 1100 MWe unit is scheduled for construction beginning in 1982 at Sizewell.

GENERAL

Summary of Activity in 1979

Nuexco estimates of world uranium production in 1979 is summarized in Table A. Production for 1978 is also shown for comparison.

Table A

ESTIMATED WORLD URANIUM PRODUCTION
(millions of pounds U_3O_8)

	1978	1979
United States	37.0	37.0
Canada	17.5	15.0
Republic of South Africa	10.3	12.5
Other Africa	15.0	22.0
Other nations*	7.2	9.5
TOTAL	87.0	96.0

*Does not include Communist areas.

Production in the US was about the same in 1979 as it was in 1978. However, average grade of ore fell considerably, from about 0.13 percent U_3O_8 in 1978 to about 0.11 percent in 1979. Thus, even though some new US production centers began operation in 1979, the new production was offset by the lower average grade of ore being processed. The 1979 production level is about twelve percent below that predicted by DOE in late 1978.

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URANIUM MARKET

Estimated production in Canada during 1979 decreased from 1978. About sixty-five percent of Canadian production in 1979 was from the Province of Ontario, at an average ore grade of about 0.10 percent U_3O_8. The remainder of Canadian production came from the Province of Saskatchewan, at an average ore grade of about 0.34 percent U_3O_8. The overall Canadian ore grade in 1979 averaged about 0.18 percent U_3O_8.

Since ore grade in the US will probably continue to decline, Nuexco now expects that US production in 1980 will be about the same as 1979 production. Total world uranium production (outside Communist areas) in 1980 will probably be around 100 million pounds U_3O_8, with most of the expected increase coming from Africa.

For comparison, Nuexco's estimates of 1979 U_3O_8 consumption (quantities of U_3O_8 which were needed to fabricate fuel for reactors operating or under construction—see Nuexco Report No. 132 for complete definition) are 26 million pounds for the US, and 74 million pounds for the total world (outside Communist areas). Thus a large percentage of world uranium production is being added to commercial inventories, which are approaching 200 million pounds U_3O_8, exclusive of stragetic stockpiles.

Total nuclear electric generation for the world (outside Communist areas) increased only slightly from 1978 to 1979. Figures for nuclear generation in 1978 and 1979 are tabulated in Table B for North America, Western Europe and the Far East. Nuclear Electric Production decreased in the US in 1979, due in part to a licensing moratorium by the US Nuclear Regulatory Commission. Net gains in Europe, the Far East and Canada more than offset the reductions in the US.

Sweden and Switzerland continue to lead in total dependence on nuclear power. About 22 percent of total 1979 electric power generation in those two countries was nuclear. Belgium's usage was about 19 percent; France 16 percent; the UK and the FRG each were about 13 percent. In the Far East, the nuclear power dependence of Japan was about 13 percent, Taiwan 16 percent, and Korea 10 percent. In North America, nuclear dependence of the US was about 11.5 percent. In the Province of Ontario, where all of Canada's operating nuclear plants are located, nuclear power production in 1979 exceeded 30 percent of its total electric power output.

Table B

NUCLEAR ELECTRIC POWER GENERATION
(millions of megawatt-hours, gross)

	1978	1979
North America		
Canada	33	38
United States	293	271
Total North America	326	309
Western Europe		
Belgium	13	12
Finland	3	7
France	31	40
FRG	33	40
Italy	4	3
Netherlands	4	4
Spain	8	7
Sweden	24	21
Switzerland	8	12
UK	37	39
Total Western Europe	165	185
Far East		
Japan	51	62
Rep. of China (Taiwan)	3	6
Rep. of Korea	2	3
Total Far East	56	71
TOTAL	547	565

In 1979, sixty-nine uranium sales transactions were completed of which Nuexco is aware. Those transactions involved a total of nearly 60 million pounds U_3O_8. Forty-one of those transactions (about 9.3 million pounds) involved delivery within one year of contract signature. The balance of twenty-eight transactions (about 49.5 million pounds were longer-term. The 1979 transactions are tabulated by buyer and seller region in Table C.

During 1979, Nuexco reported its computations of apparent future consumption (Report No. 132), estimated world uranium production (Report Nos. 133 and 134), and the natural uranium supply demand balance (Report Nos. 135 and 136). These data have been recomputed to account for the

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Table C

1979 URANIUM TRANSACTIONS BY REGION

Seller Region	Buyer Region	No. of Transactions (Quantity—millions of pounds U_3O_8)
US	US	32 (30.5)
US	non-US	16 (8.5)
non-US	US	2 (1.1)
non-US	non-US	19 (18.7)
	TOTAL	69 (58.8)

recent changes in the uranium market, and a Nuexco Topical Report summarizing the current supply/demand picture is in preparation, and will be sent to Subscribers shortly.

Government Statistics

Additions. Beginning in this issue, Nuexco will reprint the US Consumer Price Index and the US GNP Implicit Price Deflator. Current data will appear monthly in the **Statistical Data** section, with the other US Government Statistics. Data on these indexes for the years 1970 through 1978 are reproduced on pages 4.6 and 4.7 of this Report. Data for 1979, some of which are still subject to revision, are on page 4.5.

Revisions. Recent months have seen substantial revisions in the historical data of the US Bureau of Labor Statistics (BLS) industry employment series. Revisions in the Average Hourly Earnings data reprinted by Nuexco are tabulated on pages 4.7 and 4.8 of this Report. These data supersede those published in previous issues of the Nuexco Monthly Report.

The data revisions have arisen from two sources. First, the US BLS periodically adjusts its industry employment series to more recent bench marks (comprehensive counts of employment) to correct for sampling variability and for changes in industrial activity. Beginning with the October 1979 issue, "Employment and Earnings," published by the BLS, has adjusted data to the most recent bench mark, that of March, 1978. The next bench mark will be published in late 1980. At that time, monthly data after March, 1978 will be subject to adjustment to the new bench mark.

The second reason for data revision concerns changes in the Standard Industrial Classification (SIC) system. The SIC system is used to achieve uniformity and comparability in the presentation of industry data, as well as to describe structural changes that occur in the economy. The SIC manual has recently been revised. This is the first major industry reclassification since 1957. Data published in this issue of the Nuexco Monthly Report are based on the revised SIC manual ("1972 SIC Manual").

US BLS Average Hourly Earnings data for the years 1970 through 1978, as adjusted for the new SIC manual, are tabulated on pages 4.7 and 4.8 of this Report. Adjusted data for 1979 are on page 4.5. Data for the years 1970 through 1976 are based on the March 1977 bench mark. Data for 1977 and later are based on the March 1978 bench mark and are subject to revision from March 1978 forward with the publication of the next bench mark in late 1980.

AUSTRALIA

Queensland Mines has announced, based on assays of samples taken from some 8,900 truckloads of extracted ore, that its Nabarlek stockpile contains at least 26,500,000 pounds U_3O_8 at an average grade of 2.35 percent U_3O_8. Mining of the deposit was completed during 1979. Prior to mining, it was estimated that the deposit held about 20,000,000 pounds.

A comparison among the three Australian deposits from which sales have beenk authorized (Nabarlek, Ranger, and Yeelirrie) reveals significant differences in tonnage, grade, production cost, production schedule and risk. Not surprisingly, individual marketing strategies have tended to emphasize relative strengths and ignore potential weaknesses. However, the ability of the Australian sellers to take full advantage of these differences is considerably reduced by government policy, particularly in pricing. This policy is enumerated in determination letters from the government to the individual sellers which authorize discussions between sellers and potential customers, and stipulate certain minimum terms and conditions which must be included in any agreement.

There are several reasons for the Government's approach. First, uranium has been, and continues to

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be, a politically sensitive issue in Australia. Governmental control of uranium safeguards and end-use is of critical political importance. Second, also having political overtones, the government must be seen to be ensuring that Australia receives fair value in work markets for its exports, particularly in the energy area. Finally, from a legal standpoint, by using its sovereign powers to compel specific market behavior by its producers, the government intends to insulate them from further antitrust problems.

In this last regard, it may be noted that the current litigation involving Australian sellers has had no appreciable effect on marketing efforts. While the Australian government views the situation as extremely serious, sellers and many potential buyers see the situation as little more than an inconvenience which necessitates some ingenuity in structuring new commercial terms regarding passage of title, payment and shipment.

The formation of Energy Resources of Australia (ERA) continues to progress. The contemplated ownership breakdown has been adjusted as follows:

Peko-Wallsend—	30.5%
Electrolytic Zinc—	30.5%
Share offering to Australian investors—	14%
Foreign Uranium Interests—	25%

Transfer of the government's share to ERA is expected by mid-May and the share float to Australian investors will be completed by the end of June. With respect to the non-Australian investors, recent press reports in Australia note that negotiations of the terms under which these investors would take up equity in ERA are stalled. At issue is the insistance of the prospective foreign equity owners that, in return for their investment, they be granted price concessions on their share of the output. The Australian government is refusing such concessions, maintaining that its directives with respect to export sales are equally applicable to all, since any such concession would undermine the marketing efforts of all other Australian sellers.

It seems likely that the publicity about this impasse represents merely a stage of what is, no doubt, a complex and difficult negotiation. Both parties want the deal, and, without either losing face, it should be possible to resolve the issue with creative approaches in such areas, as taxes, interest rates, production costs, and return on investment.

Progress continues to be made at the Ranger project site. Figure A is a recent aerial photograph which shows that the site has been completely cleared, and the foundations of the processing plant are well under construction. A close-up photograph of the processing plant is shown in Figure B. Figure C is a plan view of the project site, included for comparison purposes.

CANADA

The British Columbia provincial government declared a seven year moratorium on uranium mining and exploration within the province. British Columbia does not have any operating uranium production centers. Most directly affected would be the Blizzard property, jointly owned by Norcen Energy Resources, Ltd., E&B Explorations, Lacana Mining Corp, and others. The owners of the Blizzard property had previously signed long-term supply contracts with Korea Electric Company.

The Liberal Party's return to power probably signals continued government intervention in Canada's uranium activities. However, the uranium producers have generally called for a reassessment of some of Canada's uranium policies. Of particular concern to the producers is the reaction among consumer nations to Canada's safeguards policies regulating the end use of its uranium. Other government policies have also been criticized as tending to put Canadian suppliers at a competitive disadvantage, such as the requirement for annual price renegotiation under long-term contracts, and the restriction of export contracts to ten years duration, with an additional five years contingent upon the state of Canadian reserves. These and other regulations are being attacked by producers as no longer necessary, and perhaps harmful to Canada's long term interests, especially in view of the substantial recent increases in Canadian reserves.

FAR EAST

Japan's anticipated 10 percent equity interest in Energy Resources of Australia (ERA), the new corporate entity that will own Ranger's Jabiru deposit, will be divided among three Japanese utilities and C. Itoh and Company, as follows:

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Figure A. Aerial view of the Ranger project site, the processing plant is in the foreground, left. The mine-site is in the center left. The tailings dam is in the background, right.

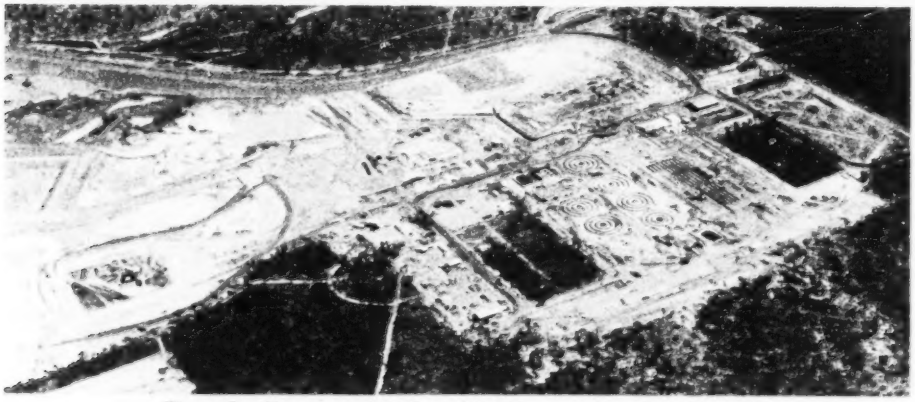

Figure B. Close-up aerial view of the Ranger processing plant site.

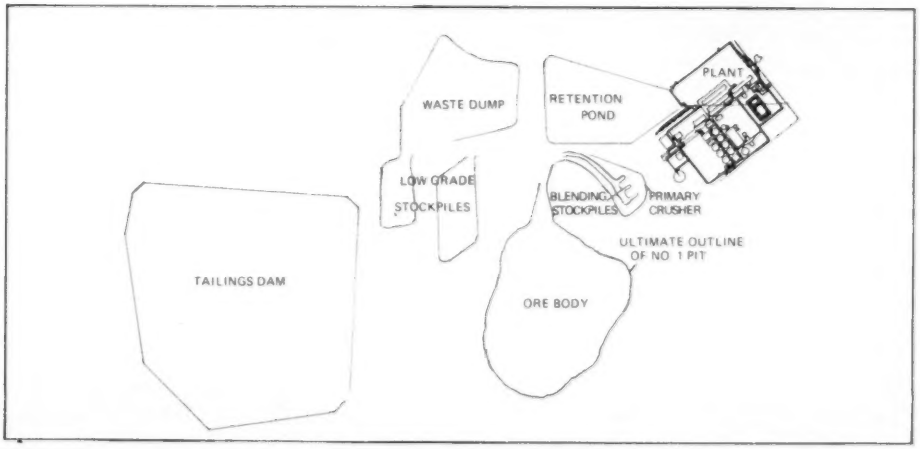

Figure C. Plan view of the Ranger project site, showing the relative location of the major components.

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URANIUM MARKET

Japanese Interest in ERA

Kansai	5.0%
Kyushu	2.5%
Shikoku	1.0%
C. Itoh	1.5%

C. Itoh's share will eventually be sold to another Japanese utility, with Chubu being the likely buyer. Although firm tonnage commitments have yet to be established, it is likely that the Japanese would seek to limit their tonnage in the early years, perhaps to that represented by their equity interests, and to commit to take additional quantities beginning in the late 1980's.

In addition to ERA, Australian tonnage will also be committed to Japan by Queensland Mines (QML) during 1980. These sales are related to the loans made to QML to finance the development of its Nabarlek project. Although contractual details have yet to be finalized and approved by the government, it is understood that letters of intent exist covering 6,000,000 pounds.

More than any other nation, Japan has evidenced the greatest concern about security of supply. Its relative inventories are the largest, as are its forward commitments both in time and quantity. The situation should be one of reasonable comfort, even by the very conservative standards of Japanese utilities. Future participation in the spot, near term and intermediate markets is unlikely unless contracted supply is disrupted. In the longer term market emphasis will be in securing post-1990 supply by gaining favored positions in exploration, development and production ventures through equity and related types of financial participation.

An announcement was made this month of a large sale by a US producer to the **Republic of Korea**. UNC Resources sold 3,160,000 pounds U_3O_8 to Korea Electric Company, with delivery extending from 1980 through 1983. The Korean nuclear program continues to expand; Korea has one nuclear unit (587 MWe) in operation, six more nuclear units (about 5100 MWe) under construction, and four more (about 3600 MWe) in active planning. By 1990, government plans call for 18 units in operation, providing 43 percent of the nation's electric power. A recent government analysis has concluded that by the year 2000, Korea will need 44 nuclear units in operation, with a total nuclear capability of 48,000 MWe, or about 60 percent of its total electric generation capacity. Korea is now heavily dependent on imported petroleum (about 60 percent of 1979 energy use) and the push to nuclear power is aimed at decreasing that dependency.

UNITED STATES

The New Mexico legislature has passed the following new severence tax schedule, which represents about a fifty percent increase over the former schedule:

U_3O_8 Price ($/lb)	Tax Rate ($/lb)	
20–25	1.10, plus 9%	over $20/lb
25–30	1.55, plus 10%	over $25/lb
30–40	2.05, plus 11%	over $30/lb
over 40	3.15, plus 12.5%	over $40/lb

The US Department of Energy (DOE) has published (45FR3948) a new schedule of uranium feed prices, as follows:

	$/lb U_3O_8	$/kg U as UF_6
Emergency sales or leases of feed	43.74	118.58
Long term sales of enriched product	21.60	60.46

A UF_6 conversion price of $4.30 per kg U as UF_6 was apparently assumed by DOE in the above prices. In this regard, Nuexco has noted that a few holders of conversion contracts are currently offering to sell conversion services on the secondary market, as described in Nuexco Report No. 138. Prices being discussed are in the range of $1.50 to $1.75 per pound U as UF_6 ($3.30–$3.85 per kg U as UF_6).

As recently as mid-1978, nearly 30 US utilities were involved to some extent in uranium exploration or development. There has been a noticeable decrease, however, both in the actual number participating and the general level of activity. Only twenty utilities are still involved at all, and no others are known to be giving it serious consideration. The gradual exodus of utilities from direct participation in uranium production is another indication that buyers generally perceive uranium supply to be adequate. US utility direct participation in uranium activity is summarized in Table D.

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Table D

US Utilities Involved in Active Exploration or Development Projects

Utility	Associated Company in Uranium Exploration and/or Production
Arizona Public Service	Kerr-McGee
Baltimore Gas & Electric	Intercontinental Energy
Commonwealth Edison	Cotter Corp.,* Edison Nuclear*
Consumers Power	Plateau Resources*
Detroit Edison	St. Claire Corp.*
Duke Power	Ogle Petroleum
Gulf States Utilities	Felmont Oil & Gas
Long Island Lighting	Bokum Resources
Middle South Utilities	Trost & Assoc., Alaska Exploration
Niagara Mohawk	U.S. Steel
Pennsylvania Power & Light	URADCO*
Portland General Electric	Trost & Assoc.
Pacific Power & Light	Nuclear Dynamics
Southern California Edison	Rocky Mountain Energy
San Diego Gas & Electric	Rocky Mountain Energy
Tennessee Valley Authority	Mobil, Federal-American Partners, UNC Resources
Utah Power & Light	
Washington Public Power Supply System	
Wisconsin Public Service	Dolores Bench Mining*
Texas Utilities	Ranchers Exploration and Development Co.

*Subsidiary company of utility

PRICING

The **Exchange Value** dropped again this month to $38.00 per pound U_3O_8, a decrease of five percent from last month. In the last 12 months, the Exchange Value has dropped 12 percent. In the same twelve month period, the US Producer Price Index—Industrial Commodities, has increased about 18 percent. Thus the real decline of uranium prices over the last year is closer to 30 percent.

The major reason for the downward pressure on the uranium market is obvious from a glance at the Market Opportunities Section of this Report (page 5.0). Material currently being actively offered for sale, available for 1980 delivery, comes to about four million pounds U_3O_8, or eight times the amount of material actively being sought for purchase, as of the end of February.

The market was very active during the past month. Eight spot or near-term transactions closed in the US. The range of prices, as tabulated on the Current Transactions page of this Report (page 4.4) is indicative of the dynamic nature of the current market. Leading the activity was the offset purchase by the Federal Republic of Germany. Over six million pounds U_3O_8 was offered in response to the German inquiry. While it is significant that about half of the material tendered was offered by inventory sellers, it is equally significant that the remainder was offered by US producers, thus indicating substantial unsold 1980 production. Following on the heels of the German purchase, several near-term buyers surfaced in the US. This made for a spirited spot market, as some of the unsuccessful offerors to the German inquiry attempted to attract those new buyers. The result was additional downward pressure on an already declining market.

The near-term uranium market has become increasingly complex. No longer are we limited to producers selling to utilities. Falling ore grade, rising production costs, and a declining uranium price have put some producers in a position where economics might favor purchasing uranium on the spot

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URANIUM MARKET

market, rather than producing it themselves, in order to deliver under long-term contracts. At the same time, the utility inventory seller remains a strong force in the market. Thus we might see producers buying uranium from utilities, or from other producers, utilities buying from other utilities, as well as utilities buying from producers.

While inventory sellers provided most of the initial downward momentum to the near-term market price, several US producers have begun to meet the competition. Thus we no longer have the seller side of the near-term market being dominated by inventory holders. As a result, several producers were successful in closing sales during the past month.

The slippage in the near-term market will very likely bring some confusion to the longer-term market. A strong buyer's market will probably make utilities even more unlikely to contract long-term if the price at the time of delivery might exceed the then-perceived market price. Sellers would be equally hesitant to contract long term without reasonable assurance that the contract would be profitable. And in the absence of sales commitments, new US production will not be forthcoming, and some existing, economically marginal US production will be phased out. To the extent that they are permitted to do so by their governments, low-cost producers from Australia and Canada might be able to sell on terms which US utilities find acceptable. Thus the uranium industry might be approaching the same crossroads that many other mineral industries have faced in the past; that of either favoring what could be lower priced imported supplies, or supporting, perhaps even subsidizing, domestic production.

This decision is especially complex due to the nature of the uranium users, the electric utilities, and the nature of uranium itself. For example:

—The utility operates in a goldfish bowl environment. Every move is likely to be second guessed by regulatory agencies, which are well aware not only of the price the utility pays for its uranium, but also of the generally perceived market price of uranium at any point in time.

—Unlike traditional utility fuels, oil and coal, uranium is produced as a standard concentrate. One producer's uranium is about as good as another's. Thus delivered prices for uranium are directly comparable among all utilities.

—Unlike oil and coal, the transportation cost of uranium is a very small fraction of the delivered price, again making utility purchases comparable.

—Regulatory agencies are unlikely to distinguish between uranium purchased on the near-term market, and uranium purchased under long-term contracts.

Thus for the first time utilities are using a fuel which is fungible on a national, or even a world level. Therefore, the utilities are often under a great deal of political pressure to pay no more than the generally perceived market price at the time of delivery. US producers are of course under just as much pressure, albeit economic pressure, to produce at a profit. With the market price falling, and costs rapidly escalating, there appears to be little likelihood of extensive long-term contracting between US producers and US utilities in the near future, since their current priorities are generally so out-of-phase. The net result may be a considerably smaller US supply sector than had once been anticipated.

Although in the longer term, it is apparent that prices must move higher if a substantial US production industry is to be maintained, it is equally apparent that near-term prices will continue to be determined by the supply/demand balance. The market is now out of balance, but lower prices can be expected to perform their classical economic function of bringing new buyers into the market (such as producers buying rather than making), and removing some sellers (such as inventory sellers deciding not to sell at the weaker prices).

Due to the large number of transactions which have recently closed, the **Transaction Value** has also changed substantially. This month's Transaction Value is $39.30, a decrease of more than six percent from last month. This month's calculation of Transaction Value is based on more recent data than last month's. The required minimum sample of ten transactions and two million pounds extended over a seven month period in Report No. 138, versus only three months in this Report. (See definition of Transaction Value on p. 4.0.)

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TOPICAL ESSAY

MARKET PRICING

Introduction

The subject of market pricing has been touched on in earlier Topical Essays. Such pricing often appears in intermediate-term and long-term uranium contracts and represents an attempt by the parties to deal with an uncertain future price situation by establishing procedures to arrive at a contract price which reflects market conditions at or near time of delivery. While this goal is theoretically reasonable, its successful application has proved both elusive and difficult, as demonstrated by the wide variety of contract approaches adopted over the past six years, as buyers and sellers sought to handle the practical problems associated with the concept.

Market pricing first gained credibility in the US with the announcement, in the fall of 1974, that TVA and Rio Algom (Canada) had adopted it in a 12-year agreement involving 17,000,000 pounds U_3O_8. Public accessibility to the TVA/Rio contract language provided a starting point, and variations of this general approach proliferated. This type of market pricing is described as the *negotiated* approach, as distinguished from the *reference* approach, which is discussed later in this essay.

Negotiated Approach

The main elements of the negotiated approach include the following:

1. *Definitions:* Typically defined are such terms as *pricing year, delivery year, buy price, sell price, settlement price* and any other terms necessary to the particular approach used.

Of particular importance is the pricing year, or when a particular delivery is priced. In earlier versions of the negotiated approach the price negotiation was conducted two to three years prior to delivery. Thus, price negotiations for deliveries in calendar year 1980 might have commenced in January 1978. However, more recent contracts provide for negotiations to start one year prior to delivery and, in some cases, in the last few months of the year prior to the delivery year. This change suggests that the contracting parties have determined that more effective and enlightened negotiations are possible when conducted closer to the delivery period.

2. *Objective:* A statement of what the parties intend to achieve. It will typically contain language to the effect that the parties intend to agree upon a price which reflects prices being paid under similar, arm's length uranium contracts. Of course, as more market priced contracts reference other market-priced contracts, the objective becomes less meaningful.

3. *Negotiation Sequence:* Outlines which party acts when. For example, the buyer might propose the first price, with the seller given two weeks to accept or counter. Or, the seller might propose first, or proposals might be exchanged simultaneously in sealed envelopes. Provisions are normally made for a period of discussion and/or further exchange of prices. Some contracts provide that, in the case of a simultaneous exchange of prices, if the proposed prices are within *X* percent of each other, they are immediately averaged to arrive at the market price.

4. *Experts:* If negotiations between the parties fail to produce agreement, the usual next step is to appoint an expert. Procedures are set forth for the expert's appointment, submissions of prices to the expert, any submissions of evidence supporting the proposed prices, and rules governing the experts' conduct, compensation and decision process. The decision process is of particular importance. Early contracts typically provided that the expert had to select a price between those proposed by the buyer and the seller. Evidence suggests that this procedure did not work as well as was hoped. A more common procedure currently in use is referred to as "baseball arbitration," in which the expert selects either the final price submitted by the buyer or the final price submitted by the seller. No compromise is permitted. It has been found that this procedure, with its attendant risk of winning or losing everything, has led to more responsible and effective negotiations, with most being settled prior to the arbitration stage.

While most negotiated market pricing involves some variation of this basic approach, there are other, fundamentally different, approaches. Of particular interest is one that provides for establishment of an initial market price which remains in effect until one of the parties requests establishment of a new market price. The intent is to avoid unnecessary negotiations in a static market, and to provide the opportunity for more frequent negotia-

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TOPICAL ESSAY

tion in a rapidly changing market. Advocates of this approach note that since the uranium market *per se* does not recognize the beginning and ending of specific time periods (calendar years or delivery years), there is no reason for the parties to obligate themselves to an expensive and time-consuming exercise when it is not clear that a negotiation will be either necessary or appropriate.

A second variation follows the standard negotiated approach, with the exception that there is no provision for experts. In this variation, failure by the parties to agree on a market price results in a partial or complete termination of the contract. Typically, deliveries will continue for some defined period—such as one year—following termination, in order to provide each party the opportunity to make alternative arrangements.

A third, quite different, approach involves an arrangement under which the pricing provisions with respect to future deliveries are agreed upon by the buyer and seller at some future date, prior to such deliveries. Of note is the fact that no mechanism, other than good faith negotiations, is specified. It is, in effect, an agreement to agree. Characteristic of this approach is the TVA/Pathfinder agreement of 1979. Deliveries are scheduled in the years 1981 through 1990, but only those during the 1981–85 period are priced, while the pricing mechanism for the 1986–90 deliveries is to be negotiated during 1984.

This type of arrangement is somewhat unusual, particularly for US buyers, which prefer precise price definition or, failing that, definition of the mechanism by which the price will be determined. A contract which lacks such procedures and precision in these areas suggests that the parties anticipate a relationship different from the conventional buyer-seller adversary relationship. An initial, firm contract period is linked to a later period by ongoing delivery obligations, subject only to agreement on price. The reopening allows each party the opportunity not only to consider price, but also to re-examine its own particular needs, the other's performance, the market place and the advantages and disadvantages of continuing the relationship. Such an approach is unlikely to be acceptable unless each party is satisfied that the other is responsible, financially sound, sophisticated in uranium market matters and likely to deal in good faith. This would, in turn, suggest that the parties may have dealt previously with each other. It would also tend to limit this approach to the larger nuclear utilities, and the larger, established uranium producers.

Reference Approach

The reference approach to market price determination involves the use of data from published, publicly-available sources. Current, prior and prospective sources include:

1. *Nuexco:* Nuexco's Exchange Value has been used in some contracts. Normally the Exchange Value used is that published on the last day of the month prior to the month in which delivery occurs. The principal variation on this scheme is the use of a moving average of several months' Exchange Value.
2. *Metals Week:* This McGraw-Hill publication has discontinued publication of uranium prices after successively (a) publishing its own price, (b) publishing its own price and Nuexco's Exchange and (c) publishing only the Exchange Value. Metals Weeks has been referenced as the source of uranium prices in at least one contract.
3. *American Metal Market:* This Fairchild publication is referenced as the source of uranium prices in at least one contract. At this time, American Metal Market publishes Nuexco's Exchange Value.
4. *US Department of Energy* (USDOE): USDOE publishes several types of price data including:
   (a) Weighted average price paid for all deliveries to US utilities during a given year. This historical figure is published annually, normally in May or June of the following year.
   (b) Weighted average settlement price paid by US utilities under market price contracts for all deliveries during a given year. This historical figure is also published annually in May or June of the following year.
   (c) The emergency feed price.

With the exception of the emergency feed price, all of USDOE's data are historical, and are generally viewed within the industry as being of little use in current market price negotiations.

5. *NUKEM Price Quote:* Quotations by this German nuclear fuel company are published monthly and are characterized as being the range of bids and offers in the European market.
6. *Uranium Price Information Service:* This ser-

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TOPICAL ESSAY

vice developed by Nuclear Assurance Corporation is in its formative stages. The type, utility, public availability and industry acceptance of its data are as yet unknown.

7. *Conventional Commodities Market:* As discussed in Nuexco Report No. 137, there is no conventional commodities market in uranium, and no market maker. Although various commodity exchanges have studied the possibility, to date none has found an acceptable approach. However, were such a cash market established, it would be expected to define market price for uranium, much as the London Metal Exchange (LME) does for copper and other metals.

A variation of the reference approach involves utilization of a published source or sources, in combination with some mechanism which the parties agree reflects longer-term price trends. Such a mechanism might be a cost-plus formula, or a base price adjusted by changes in published government indexes. Thus, price movements in published sources which reflect short-term market fluctuations would be moderated when averaged with some agreed-upon mechanism that reflects longer-term trends.

The primary advantage of a reference approach to market pricing is its simplicity and ease of use, compared to the negotiated approach. However, both buyers and sellers generally perceive a major disadvantage of this approach, namely that prices in a long-term supply agreement should not be dictated by reference sources which have historically been more reflective of spot and near-term markets. The willingness of market participants to utilize a reference approach to market pricing will be a function of their confidence that the source selected will accurately reflect their views of market level.

As noted above, published sources have, to date, tended to reflect the spot or near-term market and, as a consequence, are apt to move up and down in response to short-term market influences and the transitory market perceptions of buyers and sellers. Such movements may have little or no relationship to cost-of-production and return-on-investment which, in time, will really determine the long-term price trends in a free market. However, the shortcomings of reference sources for uranium prices are shared by many other commodities which are usually bought and sold on the basis of a cash quote on the LME, or other exchanges, even though the sale may be under a long-term contract.

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RAW MATERIALS

URANIUM DEPOSITS OF SOUTH AUSTRALIA

Introduction

The Liberal Party regained control of the South Australian government from the Labor Party on September 14, 1979. One of the new government's first acts was to announce that uranium mining within the stae would be allowed to go ahead subject to approval of an environmental impact study. The abrupt reversal of the "no mining" policy initiated by the Labor government several years earlier was a sudden and dramatic development in general and the uranium industry in particular. Plans to develop certain uranium deposits are already underway.

Uranium mineralization is known to exist in a number of locations throughout South Australia, from the town of Myponga in the south to Mount Painter and Roxby Downs in the north. It occurs primarily in association with crystalline rocks(granitic and metamorphic) of Lower Proterozoic Age in the Olary and Mount Painter districts, and in Tertiary rocks of the Lake Frome district. Figure D is a general location map of known radioactive occurrences throughout the state.

Exploration History

The first uranium discoveries in South Australia were made by early prospectors looking for gold, silver and copper. Uranium was discovered at Radium Hill in 1906. The prospector who made the discovery thought the mineral was tin, and he immediately began to develop the property. A vertical shaft was sunk to a depth of about 70 feet before the principal mineral contained in the ore was identified as davidite, a uraniferous iron titanate. The davidite occurred as vein material in fractures and shear zones within metasediments of Lower Proterozoic age. The property was mined intermittently as a source of radium bromide until 1914, but it was not until 1954 that full-scale mining was resumed by the South Australian Department of Mines. The mine closed in 1961 when ore reserves were exhausted. Total production was 954,000 tonnes of ore at an average grade of 0.133 percent U_3O_8. A total of 2,540,000 pounds U_3O_8 were recovered.

Primary and secondary uranium minerals were discovered in association with copper mineralization at Mount Painter in the Flinders Range around 1910. The primary mineral uraninite (uranium oxide) occurs in unaltered granite breccia of Archaean Age. The secondary minerals torbernite (phosphate of copper and uranium) and autunite (phosphate of calcium and uranium) were later identified in highly altered and fractured breccia. However, the grade of the uranium proved to be too low for commercial exploitation—less than one pound U_3O_8 per metric ton of ore, and property development was abandoned.

The State Department of Mines explored the East Painter areas extensively during 1946-50. Uraninite and/or torbernite mineralization was discovered at twenty-three separate locations, associated with granitic breccia similar to the main granite mass at Mount Painter. The evaluation program included almost 3,000 feet of exploratory drifts and over 7,000 feet of diamond drilling, primarily around the outer edges of brecciated granite. Program results indicate the presence of several million tons of torbernite mineralization at grades of 0.5 to 1.5 pounds U_3O_8 per metric ton.

Uranium exploration was encourage by the Australian federal and state governments beginning in 1944. Tax incentives were granted and large numbers of prospectors and companies took up the search for uranium. Most discoveries made during the subsequent 12 to 15 years were made by prospectors using hand-held Geiger counters. Some later discoveries can be attributed to airborne radiometric surveys.

Anomalous radioactivity was discovered near the towns of Houghton and Kersbrook in 1950. The State Department of Mines initiated an evaluation program which determined that low-grade uranium mineralization occurred at the outer contact of the Houghton Diorite of Archaean age and younger metasediments of Prosperozoic Age. The uranium mineral present is extremely fine grained, and is thought to be an iron-titanium-uranium oxide, similar to davidite. Locally, carnotite (postassium-uranium vanadate) is a common product of alteration, showing high-grade mineralization. Although assays exceeding one percent U_3O_8 have been recorded, the average grade of the uranium was estimated to be between 0.01 and 0.04 percent U_3O_8—too low to be economically ex-

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RAW MATERIALS

Figure D
URANIUM DEPOSITS OF SOUTH AUSTRALIA

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ploited. Similar radioactive occurrences have been noted further south at Myonga. Uraninite was identified as the uranium mineral present, but the concentration of uranium is too low to be of economic interest.

The State Department of Mines continued its aggressive exploration program for uranium, primarily in the Olary Province. In mid-1951, a new discovery was made at Crockers Well. Uranium mineralization was noted to occur as finely disseminated particles throughout a fractured breccia zone within a coarse-grained granite (alaskite). The uranium mineral was identified as a hydrous thorium-uranium-titanium oxide, very similar to brannerite. However, it was considered to be a new mineral species, and was given the name *absite*. The principal difference between the two minerals is the content of thorium and water. Absite contains almost three times as much thorium and twice as much water as does brannerite. Absite has not been identified at other prospects in the region, or elsewhere in the world.

Five exploratory shafts were sunk on the breccia zone to evaluate the mineralization. It was estimated that the property contained ore reserves of 11,000 metric tons at an average grade of 0.40% U_3O_8. The reserves were not mined at the time, due to unfavorable economics.

The uranium occurrences at Mount Victoria were discovered by the State Department of Mines in 1954, during systematic radiometric prospecting and geological mapping of the rock outcrop area. The uranium mineral davidite occurs in highly fractured and intruded metasediments of Lower Proterozoic Age, similar to the Radium Hill deposits. Following a trenching and sampling program, about 11,000 feet of diamond drilling were completed. Drilling results indicate a total of 93,000 metric tons of probable and possible ore at an average grade of 0.30 percent U_3O_8. The deposit was not mined at the time, however development plans are presently under consideration by North Flinders Mines.

The State Department of Mines has continued its search for uranium, which has resulted in a number of less significant discoveries, all confined to metasediments and intrusives. Each prospect was carefully evaluated for economic potential. The areas include Windamerta North and South and the Last Chance Mine—three prospects where secondary uranium mineralization occurs in metasediments and Old Boolcoomate, and primary uranium minerals occur in pegmatite dikes and breccia within metasediments. Other prospects of note are Nichols Nob, Moonta, Kulgera Station, Kings Bluff and Wiperaminga Hill, to name a few. Perhaps some of the early discoveries will be of interest to future uranium prospectors.

Current Exploration & Development Activity

The uranium program that was supported by the federal and state governments ended in the late 1950's and exploration activity in South Australia declined rapidly. However, further interpretation of information generated by the State Department of Mines later proved instrumental in the discovery of important new uranium deposits in South Australia.

Interest in uranium exploration was renewed in the late 1960's. The first important new discovery in South Australia was made in 1969 in Tertiary lake sediments of the Lake Frome Embayment—the first sedimentary basin in Australia known to contain uranium.

The Lake Frome Embayment is a structural basin bounded on the west by the Flinders Range and on the south by the Olary Range. Lower basin sediments consist of Cretaceous shales and sandstone overlying Precambrian granites. The Cretaceous section is overlain by Tertiary sediments about 400 meters thick. Several uranium deposits have been discovered in the upper half of the Tertiary sequences since 1969, although uranium does not seem to be present in the Cretaceous rocks.

The largest uranium discovery in this environment is the Beverley deposit. Exploratory drilling began at the foot of Mount Painter in an attempt to locate uranium redistributed by ground water from the Mount Painter deposits. Drilling progressed nearly 16 kilometers eastward into the basin before the first ore was discovered, at a depth of about 100 meters. The mineralization occurs at the oxidation-reduction interface of multiple horizons within paleochannel sand units of the Eocene and Miocene sedimentary sesquence. The main ore mineral is fine-grained uraninite, although coffinite occurs in small amounts. The ore deposits

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characteristically resemble the roll-front deposits common to Wyoming Tertiary basins. Ore reserves have been estimated at 35,000,000 pounds U_3O_8. It is probable that the ore will eventually be mined by open-pit methods. Property owners are Western Uranium Ltd. (Phelps Dodge Corp.) 50%; Transoil 16-2/3%; Oilmin 16-2/3%; and Petromin 16-2/3%.

The Honeymoon deposit was discovered during test-drilling in mid-1971. Geologically the deposit resembles Beverley, except that the main ore mineral is coffinite. Ore reserves are estimated to be about 7,500,000 pounds U_3O_8 at an average ore grade of 0.22 percent U_3O_8. It has been determined that the ore can be recovered using *in situ* leaching techniques. Plans to proceed with a pilot test plant are under consideration at this time. The property is owned by Carpentaria Exploration Company Pty. Ltd., 49%; Teton Drilling Co. Pty. Ltd., 25.5%; ARR Ltd., 21.675%; and IOL Petroleum Ltd., 3.825%.

The East Kalkaroo deposit is located about eight kilometers east of Honeymoon. Orebody characteristics are the same as Honeymoon except that the ore occurs higher in the Miocene sedimentary sequence. Indicated ore reserves have been estimated at about 2,500,000 pounds U_3O_8 at an average ore grade of 0.15 percent U_3O_8. Orebody characteristics indicate that it would be amenable to in-situ leaching. The ownership of this property is the same as the Honeymoon deposit.

The Goulds Dam ore deposit is located at the southern end of the basin. Its geologic characteristics resemble those of the Beverley deposit. Inferred ore reserves have been estimated at about 4,000,000 pounds U_3O_8. The potential to recover the ore by *in-situ* leaching techniques is being examined. The property is owned by CSR Ltd., 51%; Mines Administration Pty. Ltd., and Teton Drilling Co. Pty. Ltd., 49%.

Western Mining Ltd. controls the largest uranium reserve in South Australia at its Roxby Downs deposit, located 500 kilometers north of Adelaide. The deposit contains low-grade uranium, estimated at between 0.02 and 0.07 percent U_3O_8, in association with copper ore (between 0.75 and 2.5 percent copper) and trace gold. Uranium and gold would be recovered at Roxby Downs as a by-product of copper production. The uranium mineralization occurs in at least three zones within a sequence of black shale and carbonate sediments of Middle Proterozoic Age. The top ore zone is at a depth of 330 meters; the bottom zone is at a depth of more than 600 meters. The deposit presently extends 3,000 meters in an east-west direction, by 2,000 meters in a north-south direction, although its limits have not yet been defined.

It has been estimated that exploratory drilling could continue for up to ten years before a property development program is initiated. Roxby Downs represents the largest mineral deposit to be discovered in Australia in recent years. Ore reserves are estimated to be in the hundreds-of-millions of metric tons.

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STATISTICAL DATA

EXCHANGE VALUE—$38.00/lb U_3O_8
Determined as of February 29, 1980

DEFINITION

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

DERIVATION

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

COMMENTS

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE
Determined as of February 29, 1980

$/lb U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
39.30	4.0	12	3

DEFINITION

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U_3O_8 are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

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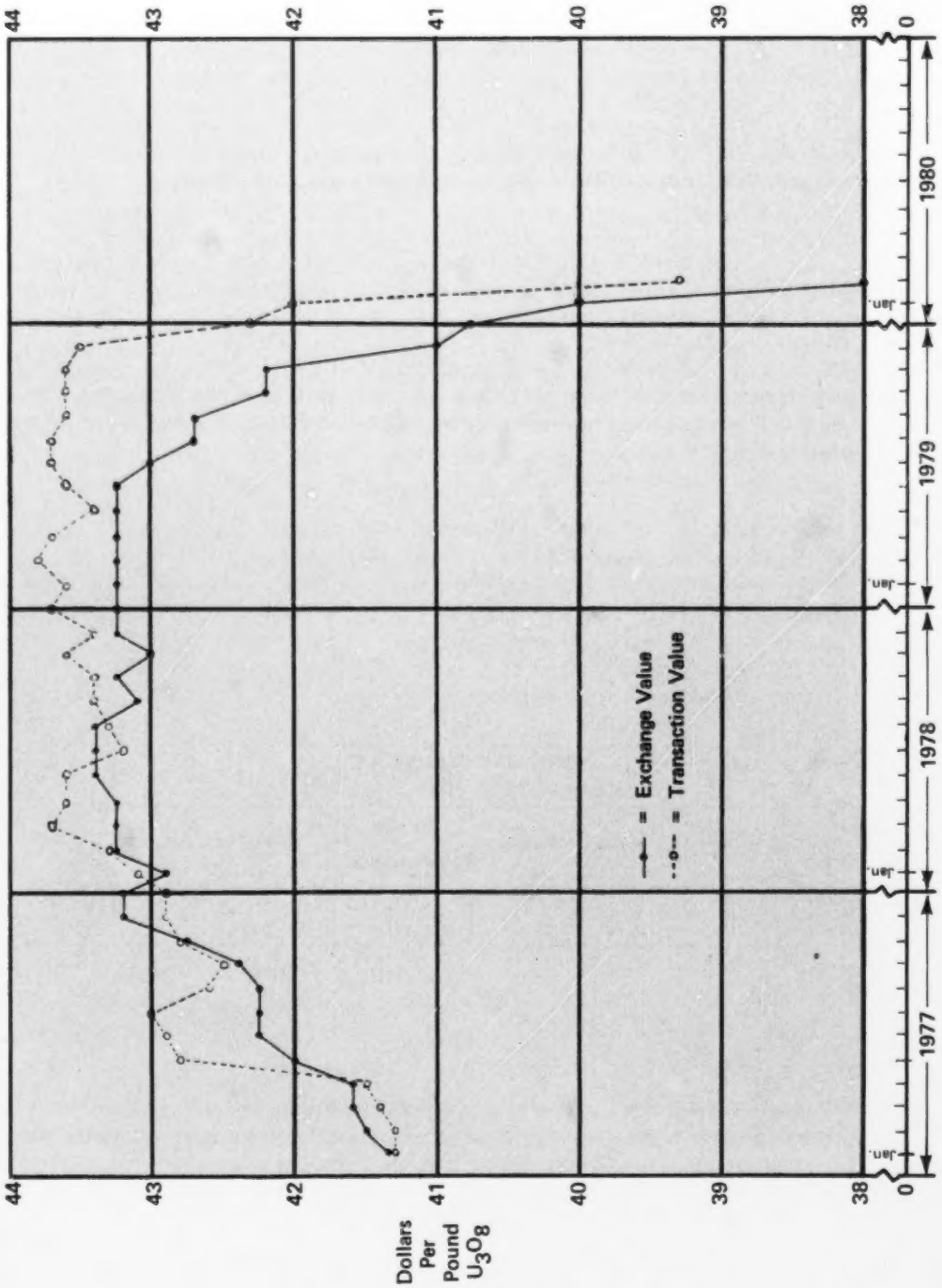
STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1977
Determined as of the last day of the month indicated
US Dollars/lb. U_3O_8



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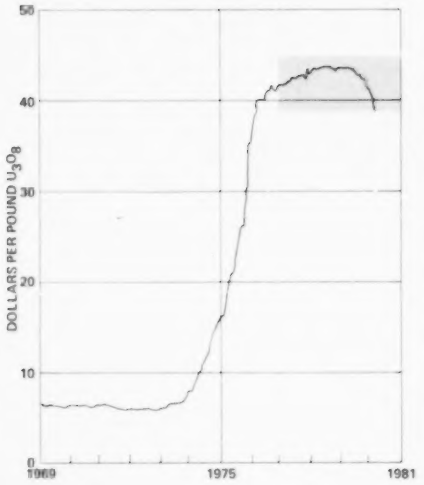
HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated

US Dollars/lb. U_3O_8



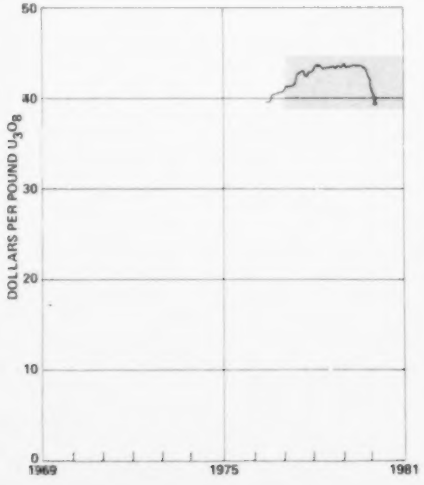
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	–	–	–	–	–	–	–	6.35	6.35	6.40	6.45	6.50
1969	–	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00										

Note: See earlier Nuexco Reports for evolution of the definition of Exchange Value.

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated

US Dollars/lb. U_3O_8



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	–	–	–	–	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30										

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STATISTICAL DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES*

Country	per lb U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates
US (dollar)	38.00	83.78	98.79
France (franc)	156.81	345.71	407.67
FRG (mark)	66.89	147.47	173.90
Japan (yen)	9,431	20,791	24,518
Switzerland (franc)	63.42	139.82	164.88
UK (pound)	16.63	36.66	43.23
Australia (dollar)	34.55	76.17	89.82
Canada (dollar)	43.50	95.90	113.09
Niger, Gabon (CFA)	7,841	17,285	20,384
South Africa (rand)	30.67	67.62	79.74

* Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

LOAN USE CHARGE RATE — 7.0%/year

DEFINITION

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

DERIVATION

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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STATISTICAL DATA

CURRENT TRANSACTIONS*

Ref	Delivery Period	Approximate Quantity	Approximate Price as % of Current E.V.	Seller Group	Buyer Group	Remarks
1040	80's	4,000,000 to 7,000,000 lbs U_3O_8	—	Africa	Europe	Price related to market at time of delivery
1044	80	100,000 to 300,000 lbs U_3O_8	103	US	US	
1047	80	100,000 to 300,000 lbs U_3O_8	—	Canada	Europe	Price related to market at time of delivery
1048	80	100,000 to 300,000 lbs U_3O_8	—	Canada	Canada	Price related to market at time of delivery
1051	80	300,000 to 600,000 lbs U_3O_8	101	US	Europe	
1052	80-81	1,000,000 to 2,000,000 lbs U_3O_8	111	Africa	Europe	
1052A	82-86	4,000,000 to 7,000,000 lbs U_3O_8	—	Africa	Europe	Price related to market at time of delivery
1054	80	100,000 to 300,000 lbs U_3O_8	100	US	US	
1055	80	100,000 to 300,000 lbs U_3O_8	92	Europe	US	Enriched UF_6
1059	80	100,000 to 300,000 lbs U_3O_8	—	US	US	Price related to market at time of delivery
1060	80	300,000 to 600,000 lbs U_3O_8	94	US	US	
1062	80	300,000 to 600,000 lbs U_3O_8	99	US	US	
1063	80	100,000 to 300,000 lbs U_3O_8	99	US	US	

* Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

	Producer Price Index—Industrial Commodities (1967 = 100) [1]	Consumer Price Index (1967 = 100) [2]	GNP Implicit Price Deflator (1972 = 100) [3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$) [4]		
				Metal Mining (SIC 10)	**Primary Non-ferrous Metals (SIC 333)**	**Chemicals and Allied Products (SIC 28)**
Annual Avg. 1970 [5]	110.0	116.3	91.36	3.88	3.87	3.69
Annual Avg. 1971 [5]	114.0	121.3	96.02	4.12	4.15	3.94
Annual Avg. 1972 [5]	117.9	125.3	100.00	4.49	4.59	4.21
Annual Avg. 1973 [5]	125.9	133.1	105.80	4.82	4.98	4.48
Annual Avg. 1974 [5]	153.8	147.7	116.02	5.43	5.63	4.85
Annual Avg. 1975 [5]	171.5	161.2	127.15	6.13	6.24	5.37
Annual Avg. 1976 [5]	182.3	170.5	133.71	6.75	6.87	5.89
Annual Avg. 1977 [5]	195.1 [4]	181.5	141.70	7.28	7.67	6.43
Annual Avg. 1978 [5]	209.4	195.4	152.05	8.23	8.56	7.01
Nov 1978	216.0	202.0	—	8.71	8.87	7.22
Dec 1978	217.2	202.9	156.68	8.72	8.97	7.28
Jan 1979	220.0	204.7	—	8.71	9.01	7.32
Feb 1979	222.5	207.1	—	8.81	9.02	7.32
Mar 1979	225.4	209.1	160.22	8.84	9.11	7.36
Apr 1979	229.0	211.5	—	9.03	9.49	7.50
May 1979	231.6	214.1	—	9.06	9.15	7.47
Jun 1979	234.0	216.6	163.81	9.09	9.44	7.53
Jul 1979	237.5	218.9	—	9.32	9.57	7.60
Aug 1979	240.6	221.1	—	9.38	9.70	7.65
Sep 1979	244.2R	223.4	167.20	9.63	9.79	7.73
Oct 1979	248.5	225.4	—	9.67	9.87	7.82
Nov 1979	250.2	227.5	—	9.79	9.86	7.87
Dec 1979	252.8	229.9	—	9.76P	9.91P	7.89P
Jan 1980	260.3	233.2	—	—	—	7.95P

P = Preliminary R = Revised

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. All data for 1977 and beyond are adjusted to the most recent benchmark – March 1978 – and are subject to revision from that point forward with the advent of the next benchmark scheduled for publication in late 1980.

(5) Data for these years, monthly except for the GNP Implicit Price Deflator, appear on pages 4.6 through 4.8 of Report No. 139, dated March 1980.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

Producer Price Index — Industrial Commodities
(1967 = 100)[1]

	1978	1977	1976	1975	1974	1973	1972	1971	1970
January	201.6	188.4	177.4	167.5	135.3	120.0	115.9	112.2	108.3
February	202.9	190.0	178.1	168.4	138.2	121.3	116.5	112.5	108.6
March	204.1	191.7	179.0	168.9	142.4	122.8	116.8	113.0	108.8
April	206.1	193.3	180.1	169.7	146.6	124.2	117.3	113.4	109.3
May	207.4	194.2	180.5	170.3	150.5	125.3	117.6	113.8	109.6
June	208.7	194.7	181.5	170.7	153.6	126.0	117.9	114.0	109.9
July	210.1	195.9	182.7	171.2	157.8	126.1	118.1	114.6	110.1
August	211.4	196.9	183.8	172.2	161.6	126.7	118.5	115.3	110.2
September	212.5	197.8	184.8	173.1	162.9	127.4	118.7	115.1	110.4
October	214.7	199.1	186.3	174.7	164.8	128.5	118.8	115.1	111.2
November	216.0	199.3	187.1	175.4	165.8	130.1	119.1	115.0	111.3
December	217.2	200.0	187.4	176.1	166.1	132.2	119.4	115.5	111.7
Annual Average	**209.4**	**195.1**	**182.4**	**171.5**	**153.8**	**125.9**	**117.9**	**114.1**	**110.0**

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes").

Consumer Price Index — Urban Consumers
(1967 = 100)[2]

	1978	1977	1976	1975	1974	1973	1972	1971	1970
January	187.2	175.3	166.7	156.1	139.7	127.7	123.2	119.2	113.3
February	188.4	177.1	167.1	157.2	141.5	128.6	123.8	119.4	113.9
March	189.8	178.2	167.5	157.8	141.1	129.8	124.0	119.8	114.5
April	191.5	179.6	168.2	158.6	143.9	130.7	124.3	120.2	115.2
May	193.3	180.6	169.2	159.3	145.5	131.5	124.7	120.8	115.7
June	195.3	181.8	170.1	160.6	146.9	132.4	125.0	121.5	116.3
July	196.7	182.6	171.1	162.3	148.0	132.7	125.5	121.8	116.7
August	197.8	183.3	171.9	162.8	149.9	135.1	125.7	122.1	116.9
September	199.3	184.0	172.6	163.6	151.7	135.5	126.2	122.2	117.5
October	200.9	184.5	173.3	164.6	153.0	136.6	126.6	122.4	118.1
November	202.0	185.4	173.8	165.6	154.3	137.6	126.9	122.6	118.5
December	202.9	186.1	174.3	166.3	155.4	138.5	127.3	123.1	119.1
Annual Average	**195.4**	**181.5**	**170.5**	**161.2**	**147.7**	**133.1**	**125.3**	**121.3**	**116.3**

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

GNP Implicit Price Deflator
Quarterly Data (Seasonally Adjusted)
(1972 = 100)[1]

	1978	1977	1976	1975	1974	1973	1972	1971	1970
First Quarter	147.05	138.27	131.47	124.21	111.28	102.89	98.76	94.40	89.81
Second Quarter	150.82	140.86	133.06	125.96	114.34	104.65	99.45	95.73	90.91
Third Quarter	153.45	142.63	134.56	128.28	117.52	106.57	100.29	96.53	91.74
Fourth Quarter	156.68	144.56	136.35	130.17	121.06	109.05	101.44	97.38	92.99
Annual Average	**152.05**	**141.70**	**133.71**	**127.15**	**116.02**	**105.80**	**100.00**	**96.02**	**91.36**

(1) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business."

Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[2] [3]

Metal Mining (SIC 10)

	1978	1977	1976	1975	1974	1973	1972	1971	1970
January	7.73	6.95	6.53	5.90	5.10	4.68	4.46	3.95	3.75
February	7.79	7.02	6.51	5.90	5.12	4.71	4.44	3.93	3.77
March	7.84	7.07	6.55	5.89	5.15	4.71	4.46	3.96	3.77
April	7.97	7.12	6.64	5.93	5.29	4.77	4.49	4.03	3.83
May	8.04	7.19	6.63	6.00	5.29	4.74	4.47	4.03	3.85
June	8.08	7.26	6.67	6.02	5.31	4.75	4.48	4.03	3.88
July	8.25	7.32	6.76	6.11	5.36	4.80	4.59	3.99	3.91
August	8.40	7.37	6.89	6.23	5.53	4.85	4.64	4.30	3.91
September	8.56	7.49	7.00	6.35	5.68	4.98	4.69	4.38	4.01
October	8.60	7.52	6.93	6.38	5.75	4.97	4.65	4.30	3.96
November	8.71	7.63	6.99	6.40	5.80	5.00	4.65	4.28	3.99
December	8.72	7.65	7.00	6.44	5.86	5.02	4.68	4.35	3.96
Annual Average	**8.23**	**7.28**	**6.76**	**6.13**	**5.44**	**4.84**	**4.56**	**4.12**	**3.88**

(2) For 1970 through 1976; US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings, United States, 1909-78," Bulletin 1312-11.

(3) For 1977 and 1978; US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings Supplement, Revised Establishment Data, November 1979."

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STATISTICAL DATA

US GOVERNMENT STATISTICS

Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$) [1] [2]

Primary Non-ferrous Metals (SIC 333)

	1978	1977	1976	1975	1974	1973	1972	1971	1970
January	8.24	7.16	6.54	5.97	5.21	4.79	4.47	3.95	3.78
February	8.28	7.20	6.52	5.96	5.31	4.79	4.45	3.95	3.77
March	8.27	7.24	6.64	6.04	5.43	4.83	4.46	3.95	3.76
April	8.32	7.34	6.74	6.04	5.50	4.82	4.47	3.96	3.80
May	8.36	7.37	6.71	6.07	5.49	4.85	4.47	3.98	3.83
June	8.56	7.71	6.82	6.25	5.59	4.96	4.57	4.15	3.88
July	8.62	7.83	6.91	6.34	5.68	5.03	4.63	4.32	3.94
August	8.66	7.78	6.96	6.40	5.76	5.04	4.65	4.35	3.92
September	8.74	8.01	7.07	6.49	5.83	5.10	4.69	4.34	3.98
October	8.84	8.07	7.10	6.53	5.86	5.12	4.68	4.28	3.90
November	8.87	8.12	7.18	6.52	5.87	5.15	4.73	4.29	3.92
December	8.97	8.15	7.18	6.44	5.93	5.22	4.77	4.40	3.95
Annual Average	**8.56**	**7.67**	**6.87**	**6.24**	**5.63**	**4.98**	**4.59**	**4.15**	**3.87**

Chemicals and Allied Products (SIC 28)

	1978	1977	1976	1975	1974	1973	1972	1971	1970
January	6.78	6.19	5.68	5.17	4.67	4.41	4.15	3.84	3.60
February	6.82	6.20	5.71	5.18	4.68	4.40	4.17	3.85	3.60
March	6.84	6.23	5.72	5.21	4.69	4.40	4.17	3.85	3.60
April	6.87	6.30	5.80	5.24	4.75	4.44	4.18	3.90	3.62
May	6.94	6.33	5.82	5.31	4.76	4.46	4.22	3.92	3.64
June	6.96	6.39	5.87	5.37	4.82	4.49	4.25	3.96	3.68
July	7.05	6.47	5.95	5.43	4.91	4.53	4.28	4.02	3.71
August	7.06	6.49	5.96	5.46	4.94	4.54	4.29	4.02	3.73
September	7.13	6.57	6.05	5.51	5.01	4.57	4.35	4.06	3.78
October	7.19	6.62	6.07	5.53	5.04	4.59	4.34	4.04	3.77
November	7.22	6.66	6.11	5.59	5.10	4.62	4.34	4.04	3.79
December	7.28	6.73	6.16	5.63	5.15	4.64	4.38	4.11	3.81
Annual Average	**7.01**	**6.43**	**5.91**	**5.39**	**4.88**	**4.51**	**4.26**	**3.97**	**3.69**

(1) For 1970 through 1976; US Bureau of Labor Statisics, Washington, D.C.; "Employment and Earnings, United States, 1909-1978," Bulletin 1312-11.

(2) For 1977 and 1978, US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings Supplment, Revised Establishment Data, November 1979."

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STATISTICAL DATA

CANADIAN GOVERNMENT STATISTICS

	Industry Selling Price Index: Manufacturing (D 500000) [1], [2] (1971 = 100.0)	Wage-earner Data: Average Hourly Earnings ($C) [3], [4]		
		Metal Mining, including milling (SIC 050-059)	Primary Metal Industries, non-ferrous (SIC 296-298)	Chemicals and Chemical Products (SIC 370-379)
Annual Avg. 1977	174.3	8.18	6.50	6.51
Annual Avg. 1978	190.4	8.76	6.82	6.97
Oct 1978	197.6	9.20	7.04	7.13
Nov 1978	198.6	9.18	7.09	7.14
Dec 1978	199.4	9.29	6.93	7.14
Jan 1979	204.8	9.19	7.14	7.29
Feb 1979	208.5	9.24	7.18	7.36
Mar 1979	210.4	9.47	7.20	7.51
Apr 1979	212.8	9.68	7.26	7.63
May 1979	214.5	9.65	7.28	7.61
Jun 1979	216.0	9.49	7.27	7.66
Jul 1979	218.3R	9.37	7.34	7.73
Aug 1979	220.0R	9.56	7.38	7.77
Sep 1979	223.4R	9.75	7.50	7.81
Oct 1979	227.2R	10.03	7.54	7.88
Nov 1979	228.1R	10.13P	7.62P	7.90P
Dec 1979	230.1P			

P = Preliminary
R = Revised

(1) Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Report No. 138, dated January 31, 1980.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Report No. 138, dated January 31, 1980.

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STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

	Price Index of Materials Used in Manufacturing Industry — All Groups (Year 1968-69 = 100.0)[1]	Weighted Average Minimum Weekly Wage Rates — Adult Males Australia Mining and Quarrying (A$)[2]
Annual Avg. 1970[3]	101.4	59.88
Annual Avg. 1971[3]	101.5	65.95
Annual Avg. 1972[3]	105.6	71.26
Annual Avg. 1973[3]	124.4	78.96
Annual Avg. 1974[3]	141.9	108.07
Annual Avg. 1975[3]	150.4	132.55
Annual Avg. 1976[3]	168.4	160.93
Annual Avg. 1977[3]	192.0	179.03
Annual Avg. 1978[3]	215.4	190.04
Sep 1978	228.1	190.26
Oct 1978	230.3	190.56
Nov 1978	232.2	190.86
Dec 1978	235.7	199.27
Jan 1979	246.3	199.76
Feb 1979	253.0	200.00
Mar 1979	264.0	201.44
Apr 1979	273.0	202.27
May 1979	287.5	203.37
Jun 1979	293.8	209.87
Jul 1979	295.8	210.48
Aug 1979	290.8	211.56
Sep 1979	300.0	212.33
Oct 1979	307.0	211.86
Nov 1979	308.0P	
Dec 1979	317.0P	

P = Preliminary
R = Revised

(1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

(2) Australian Bureau of Statistics, Canberra, "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest twelve months shown are subject to revision.

(3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Report No. 138, dated January 31, 1980.

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

SUPPLY

Nuexco Reference Number	Thousands of Pounds U_3O_8 1980	1981	1982	1983	Remarks
Uranium Available for Sale:					
1236	200	200	200		
1274	150	300	300		
1284	250				
1285	500				
1286	500	150	150	150	
1306		100	200	200	
1315			200	200	
1324		500	500	500	
1325	800				
1333	500	250	250		
1338	250				
1345	50				
1346	300				
1358	25				
1377	50				
1378	400				UF_6
TOTAL	4075	1500	1800	1050	
Uranium Available for Loan:					
1136	2000				UF_6
1175	725				UF_6
1234	700				
1239	1000				UF_6
1354	600				
1355	600				
TOTAL	5625				

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MARKET OPPORTUNITIES

DEMAND

Nuexco Reference Number	Thousands of Pounds U_3O_8				Remarks
	1980	1981	1982	1983	
Inquiries to Purchase:					
1146			300		
1227			300	300	
1260		800			
1321			400	400	
1322				250	
1335	500				
1357		300			
TOTAL	500	1100	1000	950	

Inquiries to Borrow:

1034	800
1120	500
1121	500
1220	1000
1240	1000
1308	200
1348	500
TOTAL	4500

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